MONOPOLIES AND MERGERS COMMISSION

London Underground Limited

A report on passenger and other services supplied by the company

Presented to Parliament by the Secretary of State for Trade and Industry by Command of Her Majesty
June 1991

Members of the Monopolies and Mergers Commission as at 29 April 1991

Sir Sydney Lipworth *(Chairman)*
Mr P H Dean *(Deputy Chairman)*
Mr H H Hunt CBE[1] *(Deputy Chairman)*
Mr H H Liesner CB *(Deputy Chairman)*
Mr A G Armstrong
Mr C C Baillieu
Mr I S Barter
Professor M E Beesley CBE
Mrs C M Blight
Mr F E Bonner CBE[1]
Mr P Brenan
Mr J S Bridgeman
Mr L Britz
Mr K S Carmichael CBE
Mr R O Davies
Professor S Eilon
Mr J Evans
Mr A Ferry MBE
Mr D G Goyder
Mr M R Hoffman
Mr J D Keir QC
Mr A L Kingshott
Miss P K R Mann
Mr G C S Mather
Mr L A Mills[1]
Professor A P L Minford
Mr J D Montgomery
Mr B C Owens
Professor J F Pickering
Mr L Priestley
Mr D P Thomson
Mr C A Unwin MBE
Mr S Wainwright CBE
Professor G Whittington[1]
Mr R Young[1]

Mr S N Burbridge *(Secretary)*

---

[1]These members formed the group which was responsible for this report under the chairmanship of Mr H H Hunt.

Contents

			Page
Chapter	1	Assessment	1
	2	Background and statutory framework	12
	3	Management and organisation, and planning	16
	4	Financial framework and control	30
	5	Management information systems	48
	6	Industrial relations, pay and employment policies	56
	7	Efficient use of manpower	66
	8	Operational capacity and management of existing resources	81
	9	Matching services to demand	111
	10	Fares	128
	11	Investment	142
	12	Project management	163
	13	Commercial use of assets	171
	14	Quality of service	181
	15	Summary of recommendations	212
		Glossary	224

Appendices

(The numbering of the appendices indicates the chapters to which they relate.)

1.1	The reference and background	231
1.2	List of interested third parties	233
2.1	Case studies of two line businesses	234
2.2	Safety	268
3.1	LUL Board Safety Committee	274
3.2	LUL Safety Management Group: terms of reference	277
3.3	LUL Finance Committee: terms of reference	279
3.4	LUL Executive Committee: terms of reference	280
3.5	LUL senior management structure	281
3.6	Duties of Line General Managers	282
4.1	Analysis of forecast overrun, 1990/91	283
4.2	Comparison of achieved actual at period 12 with latest forecast out-turn for 1990/91	284
5.1	Regular management information reports	285
6.1	Trade union membership at 6 September 1990, analysis by main function	287
6.2	RNC machinery: composition of Sectional Councils	288
6.3*(a)*	Proposed new negotiating machinery	289
6.3*(b)*	Proposed new negotiating machinery: terms of reference and representation	290
6.4	Summary of industrial action, 1980 to 1990	291
8.1	LUL passenger rolling stock	292
8.2	Rolling stock depots	293
8.3	Scheduled train maintenance cycles	294
8.4	Scheduled maintenance of rotating machines	295
8.5	Scheduled cleaning cycles	296

8.6 Engineers' train fleets 297
8.7 Inventory of premises and structures 298
9.1 Demand: information, modelling and forecasting 299
11.1 Project appraisal 305
13.1 Schedule of income and expenditure for property, advertising and ancillary services, 1987/88 to 1994/95 308
13.2 LT Property: divisional structure 309
14.1 Retimetabling the Bakerloo Line 310

1 Assessment

1.1. On 30 October 1990 the Secretary of State for Trade and Industry referred to the Commission certain questions concerning the efficiency and costs of and the service provided by London Underground Limited (LUL) in supplying passenger and other services (see Appendix 1.1). LUL is a wholly-owned subsidiary company of London Regional Transport (LRT) which is closely involved in LUL's affairs. For example, LRT receives Government grant for public transport in London and apportions LUL's share to the company, and in consultation with the Government, it determines LUL's fares policy. We were grateful for LRT's and LUL's complete co-operation in the inquiry.

1.2. We discuss here the main issues arising from the reference which required a wide-ranging inquiry covering most aspects of LUL's affairs. A summary of our recommendations appears at the end of the report in Chapter 15. We indicate priorities for action in paragraph 1.47.

Performance

1.3. The public's perception of an erratic, overcrowded and poorly maintained service in many areas is broadly correct, although the picture for the Underground as a whole is more favourable. For the most part the deficiencies in the levels of service are the result of chronic underinvestment in both new capacity and the replacement and renewal of existing assets, an unforeseen dramatic growth in traffic and the disruption arising from radically improved safety provisions. Even with unlimited availability of investment funds the time-scale for any marked alleviation of overcrowding would not be felt for a long time because it would require the construction of new lines, and these take 15 years or so from conception to completion. One such line, East-West crossrail, from Paddington to Liverpool Street has been approved by the Secretary of State for Transport. LUL believes that a Chelsea-Hackney Line will also be necessary if congestion is to be substantially reduced and the Secretary of State is safeguarding this route. Meanwhile LUL expects that significant levels of regular inconvenience and discomfort will continue to be suffered by passengers as demand grows. At a less visible but nevertheless critical level, LUL estimates that it will take at least ten years to bring its permanent way up to standard, and this is on the uncertain assumption that the necessary funds will be available. On a more encouraging note there is the prospect of a reduction in disruptions resulting from smoke alarms when LUL's safety programme is complete (see paragraphs 14.121 and 14.123).

1.4. LUL set four Business Goals in June 1990:

(a) The maximum number of trains to be running in the peak, at regular intervals, by end of *September 1990*. This meant single figure cancellations for the network as a whole.

(b) An escalator service to meet customer expectations by April 1991. This meant no more than 35 escalators out for any reason. Emphasis was to be placed on minimising the downtime of individual machines.

(c) A welcoming and customer-friendly environment by April 1991. This had implications for cleanliness, staff presence and attitudes, technology and policing.

(d) Asset maintenance and renewal so that the system performed well and looked good. This would be a five-year programme covering track, signalling, escalators, stations and trains.

LUL has failed so far to meet the first goal because of particular problems with rolling stock on the Victoria and Piccadilly Lines. LUL believes that financial constraints will continue to make it difficult to achieve although we note that LUL has been close to it in some months. The second goal has been achieved by LUL, but it told us that budgetary constraints were now likely to cause some slippage. This would in our view be particularly unfortunate because passengers find shortcomings here extremely irritating. The third goal is also likely to suffer as a result of the recent action to cut costs: LUL said that a number of things which contribute to cleanliness, appearance and customer friendliness had been deferred. Present indications are that the fourth goal will not be achieved within the targeted time-scale.

1.5. In the terms of reference, we are asked first of all whether in supplying its services LUL could improve its efficiency and thereby, without affecting targeted improvements in levels of safety or in the quality of the service provided, reduce its costs. We have taken account of two general considerations and four particular factors in assessing LUL's performance.

1.6. The first of the general considerations is that we have in our discussions with LRT and LUL discerned a conflict between LUL's commercial objective of generating enough cash to cover both operating costs and the funding of renewals and replacements, and LRT's and hence LUL's legal obligation to have due regard to London's public transport needs. This has to be seen against the background of a market where substantial real price increases are judged to be politically unacceptable. The second consideration is that LUL has to operate within a financial framework which does not facilitate the development of a consistent long-term policy in respect of the setting of fares and the planning and funding of investment. One aspect of this is the provision of ring-fenced funding to finance new lines while LUL's fundamental requirement to maintain and upgrade the existing network is to a great extent starved of the necessary funds.

1.7. The four particular factors are:

(a) the weight of safety considerations after the King's Cross fire in November 1987;

(b) the present state of the Underground;

(c) the steep increase in passenger miles over recent years; and

(d) changes in LUL's senior management and in its management structure.

1.8. The issue of safety on the Underground has occupied a great deal of senior management time since the King's Cross fire and required the implementation of major programmes of safety works. Without implying any criticism of LUL's making safety its first priority, the intensive efforts to improve levels of safety must necessarily have reduced the time available for other matters, including the pursuit of improvements in operating efficiency.

1.9. The Underground is an old system which, as we have already indicated, has over many years not been renewed at a rate necessary to sustain an efficient rapid transit railway. The most heavily used parts are generally at deep level in narrow diameter tunnels served by trains which are amongst the smallest in the world. Here, significant constraints on improving performance or increasing capacity are the tunnel size, tight curvatures, the great difficulties in the way of increasing platform lengths, and the difficult geography of existing stations including an insufficient provision of lifts and escalators to cope with present traffic volumes.

1.10. These inadequacies have been exacerbated by an increase of around 50 per cent in passenger demand over the last decade which has overstretched the system and frequently increased congestion to levels requiring the temporary closure of stations.

1.11. There have been significant changes in LUL's senior management in recent years. The Chairman was appointed in March 1989, the Managing Director in August 1988, the Engineering Director in January 1989 and the Finance Director as recently as February 1991. LUL has over this period been seeking to change its culture from a largely reactive style to one of pro-active planning and management. In November 1988 it decided to establish ten line businesses with all other activities becoming supportive to those businesses. Good progress has been made but as implementation is not complete, it is too early to reach any conclusion on whether the new structure will deliver improvements in efficiency. At this interim stage, management recognises that LUL is doing unnecessary business with itself in the form of internal contracts, resulting in duplication of effort and of staff.

1.12. After taking these reservations into account, we have concluded that LUL could improve its efficiency and reduce its costs without the effects on safety and quality of service mentioned in paragraph 1.5. There are particular weaknesses in cash control both in securing fares income and in control of spending, and in management information systems generally. Despite the devolution of certain responsibilities to line businesses the staff of LUL's central directorates has shown a threefold increase since 1986. There are sound reasons for much of this increase but LUL recognises that there is some duplication of effort (see paragraph 1.19). It also said that in the post-King's Cross fire atmosphere of crisis, staff were thrown at the problem of safety in excessive numbers, and it intended that the number of staff should be sensibly managed down. In this connection we strongly support LUL's more recent work on risk assessment aimed at making the best use of available funds. LUL has told us that labour practices which restrict productivity (some unofficial and some embodied in agreements-see paragraph 1.34) still exist and that it intends to deal with them in the course of its current value analysis programme. It conceded that there was substantial scope for improvements in the efficiency of rolling stock maintenance but said that it was partly dependent on modernising its depots.

1.13. We have also been asked whether the quality of service provided could be improved without any increase in costs: it follows from paragraph 1.12 that it could, but this does not imply that the resulting level of service would be satisfactory.

1.14. The last broad question in the terms of reference is the extent to which a higher quality of service might generate higher net revenue. The short answer is that real fares increases justified by improved quality of service would increase net revenue. However, leaving aside the matter of whether LUL would be allowed to introduce significant real fares increases (see paragraph 1.21), it would not be possible for LUL's present ticketing system to reflect quality improvements in different parts of the network in the fares for the particular services concerned.

Investment in the Underground

1.15. The need for investment in the Underground at a much higher level than in the past has been recognised on all sides. In order to provide an acceptably modern network, LUL sees the need for an average expenditure of £700 million to £750 million a year over the remainder of the decade, excluding the cost of new lines and extensions to existing lines. By comparison, investment over the last five years averaged £290 million a year at 1990/91 prices. On the basis of current provisional funding guidelines, LUL plans to invest £384 million, also at 1990/91 prices, in 1991/92. Given the fierce competition for scarce Government funds, it is unlikely that the Government will meet the whole investment need foreseen by LUL. Equally it is unrealistic to expect increased efficiency on the part of LUL, imperative though this is, to bridge the gap. In our view there will have to be an enhanced contribution from real increases in fares.

1.16. The balance between Government finance and real fares increases is a matter for the Government to determine in consultation with LRT. We would merely observe that Government policy in this matter needs to be clear and to recognise, as far as it is feasible to do so, the long planning horizon, ten years or more, necessary for the efficient management of a modern railway. LUL must play its part. Its recent investment plans have been unrealistic and resulted in considerable problems when these plans failed to match the funding available and had to be scaled down. LUL must plan on the basis of the resources likely to be available.

1.17. As regards the contribution from increasing efficiency, we have noted LUL's productivity target of 2 per cent each year on average over five years and have recommended that it should be seen as a minimum target to be achieved. The unions have indicated to us their willingness to co-operate in measures to improve productivity but, above all, it will require firmer and more systematic direction by senior management than has been evident in the recent past. It seems to us that financial constraints have provided the spur for the currently proposed reductions in costs rather than a sustained drive for improved efficiency. Both the taxpayer and the fare-paying passenger are entitled to value for money. LUL needs to demonstrate on a continuing basis that it is making the best use of existing resources in an efficient and business-like way.

1.18. We now turn to the special questions in the terms of reference:

(a) the scope for improvements in efficiency and manpower productivity and the appropriateness of the management structure;

1.19. Taking management structure first, we found that it was designed to facilitate a more commercial approach, to reduce the number of management tiers and to meet criticisms in the aftermath of the King's Cross fire that the Underground was undermanaged. We also found that the resulting spans of control, at near double the accepted practice, were too wide for effective control; that the introduction of the client and internal contractor concept had resulted in fragmentation of responsibility and duplication of effort; and that the present level of devolution to line businesses needed to be developed further, as LUL planned to do. We have recommended that LUL should review its Headquarters structure with the aim of reducing spans of control below double figures and that it should take steps to clarify responsibility and eliminate duplication by October 1991.

1.20. We have already indicated in general terms the scope for LUL to improve its efficiency and manpower productivity (see paragraph 1.12). We review particular matters in more detail under subsequent headings.

(b) the method of determining the level and structure of fares and the relationship of fares both to cost structures and to the level of peak and off-peak demand on the network;

1.21. LRT, and hence LUL, have not been able to raise fares in real terms by as much as they wished because of Government concern over the fares increases proposed, although in principle the Government supports an element of real pricing in LUL's pricing policy. At the same time LUL's ability to change its fares structure has been constrained by requests from the Government not to raise individual fares by significantly more than the average fares increase. We believe this has damaged LUL's ability to achieve both the objectives of its fares policy and to plan ahead, and we have made a number of recommendations aimed at improving matters.

1.22. Many of the costs of providing LUL's services are not specific to the operation of individual services at particular times of day and this raises formidable allocation problems. Nevertheless, in our view, the allocation of costs on a regular basis to specific lines, and where appropriate sections of lines, at different times of the day would help LUL to set fares which more truly reflect costs and help to identify those services which are not covering their marginal costs of operation. LUL needs to develop a clear pricing policy and to produce the cost data necessary for its successful implementation. We have recommended accordingly.

(c) the management of LUL's investment programme and the appraisal and management of individual capital projects;

1.23. LUL has acknowledged that its past record of project management has been unsatisfactory but over the past two years it has, we believe, taken steps to assess the resources required for managing the increased level of project activity arising from the significantly enlarged investment programme. We have made a number of recommendations further to improve matters particularly by establishing procedures for monitoring overruns or overspends and making better use of LUL's computerised project management system.

1.24. The planning process within the Underground Investment Programme (UIP) has in the past been based on unrealistic assumptions about future levels of funding which cause problems in arriving at well-considered investment plans. We are concerned that LUL has not always considered enough options in looking at investment. Increased effort here would help it to respond with greater flexibility to funding constraints. More fundamentally, we have recommended that the UIP for future years should be based on the three scenarios approach recently proposed by LUL-Treasury guidelines, essential and desirable levels of expenditure; and should spell out the implications of different levels of funding, including the interrelationship between projects and the effect on the achievement of Business Goals. We have also recommended that LUL should, within the next UIP, make more systematic use of information on cost benefit ratios and the financial impact of projects in arriving at its project priority ranking, and that it should ensure that a full risk assessment of investment in safety is in place by the end of 1991.

1.25. On the matter of investment appraisal, we have concluded that LUL should do more to present options to the LRT Board, including the different funding implications, and more to assess the effect of delaying projects on its costs. We have recommended accordingly and made a number of other recommendations concerning particularly the basis for assessing projects, the need to carry out systematic sensitivity analysis and to base maintenance and renewal of such key assets as the permanent way, rolling stock and signalling on an optimal replacement policy which takes account of costs, revenue and passenger benefits.

(d) the efficiency of LUL in adjusting services to match demand and whether greater efficiency would increase net revenue;

1.26. We have been impressed by the technical modelling capability of LUL in its planning to match services to demand. It has not, however, been able to deliver its planned service. We are also concerned that it has tended to concentrate on peak services and has not given enough attention to off-peak services.

1.27. LUL's recent review of service levels showed that there are areas where operating costs can be reduced. We are concerned that these savings only appear to have been identified and brought forward as a result of a cash crisis, though LUL told us that these potential cost savings would have been identified and introduced in due course. This suggests to us that LUL does not routinely scrutinise its services as rigorously as it should. We have recommended an annual review of all investment and operating expenditure affecting capacity in order to ensure that the balance between expenditure in different areas is appropriate.

1.28. In the central area during peak periods LUL provides as many trains as practicable within the current operating constraints, which as we indicate in section *(e)* may be only marginally alleviated by improvements in efficiency. There is otherwise no scope for increasing supply by means other than investment to increase capacity. At other times, and outside the central area, there may well be further scope for modifying services to match demand more closely but the absence of the necessary cost information makes evaluation difficult. We have found that there is a particular need to determine the costs and benefits involved with services at the margins of the operating day and at weekends. We have recommended that such analyses should be conducted every two years and that the first should be completed within one year.

1.29. We have made a number of other recommendations in the areas of passenger benefits and operating decisions, the effect of the one-day Travelcard on the evening peak and forecasts of demand, all aimed at improving LUL's efficiency in adjusting services to match demand and thereby increasing net revenue.

(e) the extent to which any deficiency in the quality of service is the result of inefficiency and in particular whether there is scope for improving the quality of LUL's service by making more effective and efficient use of existing resources;

1.30. LUL has been slow in developing the information and methods it needs to determine optimal maintenance and renewal policies, but it is now working to put this right. This is important because improvements here will enable LUL to make better use of its resources and so improve its services.

1.31. Cancellations and failure to achieve regular service intervals exacerbate overcrowding on the Underground. We have found that there is scope for reducing cancellations across the network through more vigorous and well-directed management action. We have recommended that action taken by Northern Line management to reduce cancellations should be applied to other lines, where appropriate, by October 1991. We have also made a number of specific recommendations which seek to achieve a reduction in rolling stock failure rates. Disruptions to the regular running of services arise for a number of reasons, some of which are not within LUL's control, for example smoke or fire alarms and security alerts. Within LUL's control are delays and disruptions arising from equipment failures or human error. We have concluded that LUL's failure to achieve regular service intervals has resulted, in part, from insufficient management attention to these matters within its control. We have made recommendations aimed at improving LUL's performance in this area, including the speed of restoration of services after disruption.

1.32. The measures we have suggested will be useful but they do not address the capacity constraints on the network. We would expect them to effect only a marginal improvement in overcrowding.

(f) the scope for improving operational capacity, reducing overheads and, with due attention to safety, securing reductions in operating, maintenance, repair and renewal costs particularly by improving working practices, optimum timing of work and contracting out appropriate work;

1.33. We have said in sections *(d)* and *(e)* that LUL provides as many trains as practicable during peak periods in the critical central area and that only marginal improvements are currently feasible. There is, however, substantial scope for reducing overheads and, without affecting safety, securing reductions in operating and maintenance costs, as we have indicated in paragraph 1.12.

1.34. LUL has told us that customs and practices which constrain productivity are prevalent in certain areas and in some instances are condoned by local managers. Furthermore, negotiated collective agreements contain terms which, in themselves, may inhibit improvements in productivity. Planned preventative maintenance work on rolling stock is out of phase with the availability of that stock. Planned maintenance intervals do not reflect real need and could lead to over-frequent maintenance and excess costs; nor are they effectively linked to managing or containing failures. Maintenance turnround times are excessive and may lead to higher costs. Performance in the incorporation of approved modifications, particularly those related to safety, has been unsatisfactory. We have made recommendations in all these areas.

1.35. As to contracting out, we have noted that the bulk of maintenance and renewals work is carried out in-house. The trade unions and some local managers are opposed to the principle of competitive tendering and the position is particularly delicate because of the safety implications of contracting out in a railway environment. We have recommended that LUL should pursue a policy of increasing competition in all areas where external contractors are competent to tender for work and can operate within LUL defined and controlled safety standards.

(g) **the quality and effectiveness of LUL's systems of allocating costs to its business units and divisions and for monitoring and controlling these costs**;

1.36. We have commended LUL's line contribution and related approaches to the identification, monitoring and control of its costs. However, LUL's intra-business charging system, which intends to ensure that costs are borne by those units which incur them, appears to be unduly complex and to involve work and negotiation disproportionate to its objective. We have recommended that LUL should review this system with a view to simplifying it.

1.37. LUL has employed and been set a target for total costs per train mile as a measure of its efficiency. We have recommended that this measure should be supplemented by a variety of measures related to other important operational characteristics such as numbers of employees and/or value of assets employed, and that LUL should also make use of measures of profitability related to passenger journeys and passenger miles.

(h) **whether LUL makes full commercial use of assets, including the use and redevelopment of properties in its operational use, and in the provision of ancillary services and concessions.**

1.38. LUL and London Transport Property (LTP) have wholeheartedly adopted the principal recommendations of the MMC's 1985 report on the efficiency and costs of the British Railways Board in its property activities. Their procedures are commendable and senior staff have adopted a pro-active approach to property development and estate management. However, we have concluded that two effects of the financial regime within which LUL operates have been to discourage an optimal disposal strategy for LUL's assets and to cause or contribute to the postponement of a number of highly profitable commercial projects capable of significantly enhancing LUL's secondary income in respect of additional commercial units, state-of-the-art vending machines and platform telephones following proposals in LUL's Retail Business Plan.

1.39. As far as advertising on the Underground is concerned, we have concluded that London Transport Advertising (LTA) could be lighter on its feet in responding to changing market conditions and so optimising its realised prices. We have also found that LTA's method of apportioning costs appears to be inadequate, in particular, for revealing the extent of any cross-subsidisation between LUL, London Buses Ltd (LBL) and Docklands Light Railway Ltd (DLR) and for facilitating the rationalisation of the historically large number of advertising sites on the Underground through the identification of those from which the revenues obtained are insufficient to cover costs.

1.40. We have made a number of recommendations (some addressed to the Department of Transport (DTp)) aimed at improving matters in these areas.

1.41. Certain other matters arising from our inquiry are, in our view, particularly important:

Financial framework

1.42. Operating within the external financing limit (EFL) system in an uncertain environment requires strong competent management. Whatever the reasons for changes in income or expenditure, it is important for there to be proper control over cash flow and commitments, so that swift management action can be taken. LUL's financial control proved to be inadequate in 1990/91. Its other arrangements associated with such matters as project control (especially in relation to cash as against value of work done) were similarly inadequate to enable prompt and suitable remedial action. We have made a number of recommendations aimed at improving

LUL's control over cash flow and commitments which we trust will reinforce its own endeavours in this direction. We have in particular recommended that responsibility for the monitoring of cash overspends and bringing these to the notice of the individuals responsible and for the management and control against the capital grant should be firmly placed on the company's Finance Director, who should nominate one specific individual to monitor and control all the elements comprising the EFL. We are glad to note that LUL has decided to cease making a slippage allowance in its project expenditure budgets. We have also recommended a rearrangement of existing EFL procedures to permit a measure of flexibility to cover expenditure phasing variations.

1.43. We have made a number of other recommendations aimed at improving the presentation of LUL's results, including additional measures of efficiency.

Management information systems

1.44. There is widespread dissatisfaction within LUL about the quality of its management information and internal management reports. We have concluded that both the number and volume of reports are excessive and that they are insufficiently focused on the key areas of management performance. Moreover they are insufficiently directed towards the provision of financial information and, in particular, financial measures and efficiency ratios. We have recommended an urgent review of these reports and that it should specifically take account of the latter need. We have also concluded that on-line information should be more widely available and should be made more comprehensive in its coverage and we have recommended accordingly.

Formal planning

1.45. The various external strategic planning exercises which influence a major part of LUL's strategy have a wide range of social benefit objectives. The internal objectives set for LUL are based on financial and quality of service targets. Nevertheless, LUL is required to carry out its investment appraisals using cost benefit analysis criteria including passenger benefits and external benefits. We have concluded that LUL is faced with conflicting objectives to an unusual degree and have recommended that LUL should put forward proposals to establish a clear framework of objectives for agreement by DTp by the end of 1991.

1.46. The business plans prepared by the lines for 1990/91 show a wide variation in both style and content. This may indicate a lack of clarity about their purpose. We have concluded that there is a need for a more standardised structure for line business plans and have recommended that LUL should take steps to identify the best practice in the existing line business plans and to incorporate this within the central guidelines for future plans.

Priorities for action

1.47. In the conclusions to the individual chapters of our report we make a number of recommendations which are summarised in Chapter 15. There are six matters which we believe should collectively have priority:

(a) control of cash against the EFL;

(b) management information systems;

(c) utilisation of manpower;

(d) fares policy and levels;

(e) management of investment programme and projects; and

(f) renewal and maintenance of the network.

The recommendations which require particular attention in those areas have been set out in bold type in Chapter 15.

Conclusion

1.48. Our inquiry has naturally concentrated on areas where LUL's performance could be improved but in our overall assessment of the public interest it is right that we should also recognise achievements on the Underground in recent years. Since the King's Cross fire, comprehensive safety management systems have been established involving LRT as well as LUL. There has been a marked improvement in the efficiency with which LUL physically resources and manages its many investment projects. The Underground Ticketing System (UTS) has been successfully implemented and substantial progress made with One Person Operation (OPO) of trains by conversion of eight of LUL's ten lines. Some 60 station modernisation schemes have been completed and the network appearance improved, particularly at the heavily used central area stations. Not least the Central Line Refurbishment Project has been commenced at a total cost of some £700 million at 1990/91 prices.

1.49. As we have already made clear, the efficiency with which LUL uses its present resources still leaves much to be desired. LUL is a long way from providing an acceptably modern network. Provision of such a network is important to the future of London and indeed to the United Kingdom as a whole, and will require massive investment by LUL over a long period. However, past failures to renew the system cannot be laid at the door of the present leadership of LUL.

1.50. The present management will be judged, at least in part, by its ability to persuade the Government to commit a stable investment programme for major improvements and extensions to the system, and to recognise the importance of real fares increases in matching revenues to costs. Recent history suggests inadequate performance by LRT and LUL in getting their case across to DTp and/or by the Department in getting the case across to HM Treasury (HMT). The travelling public has been the principal victim of underfunding and will no doubt be so for a number of years to come.

1.51. LUL has so far failed to grapple adequately with the problems associated with cash control, particularly in regard to investment projects. This is a major task and requires a substantial change in approach if the EFL difficulties which arose in 1990/91 are not to be repeated in 1991/92 and subsequently. We are also particularly concerned that there are serious shortcomings in LUL's management information systems; that LUL lacks a clear pricing policy and the data necessary for its successful implementation; that LUL has not yet got to grips either with customs and practices which it says constrain productivity in certain areas, or with negotiated collective agreements containing terms which, in themselves, may inhibit improvements in productivity; that LUL's investment programme has been based on unrealistic

assumptions about future levels of funding; and that the renewal and maintenance of the network has been neglected. All these matters point to a lack of rigorous management of LUL's activities over a long period.

1.52. We have to say whether in relation to any matter falling within the questions set out in the terms of reference LUL is pursuing a course of conduct which operates against the public interest. We have noted in paragraph 1.48 substantial achievements by LUL. We have also made it abundantly clear that there are serious failings. In some cases LUL commenced appropriate action to put matters right in the course of our inquiry but, for example, it is too early to say whether improvements introduced in the critical area of control of expenditure, and in particular in the control of cash outgoings, will be successful. Some deficiencies, particularly in regard to the renewal of the network, will, after many years of neglect, require substantial assistance from the Government if they are to be put right. There is room for differences of opinion as to whether LUL itself has taken adequate steps to remedy existing failings. Bearing in mind that there is a relatively new senior management team which needs a reasonable period of time fully to prove itself, and the severe financial constraints under which it operates, we feel that LUL deserves the benefit of any doubt about the consequences of its present conduct. We therefore refrain from concluding that, at this time, LUL is pursuing a course of conduct which operates against the public interest, although if adequate remedies are not found for the deficiencies we have identified, the result in terms of the level of service provided by LUL may indeed be contrary to the public interest.

1.53. It is clear from the range of our recommendations that many things necessary for improvement in LUL's performance are not yet in place. LUL cannot be expected to take instant action in all areas. With this in mind we have in paragraph 1.47 listed the areas which we believe should have priority, and in these and in some other areas we have, where appropriate, agreed with LUL specific target dates for implementation of our recommendations. These targets must be met.

2 Background and statutory framework

Background in brief

2.1. The Underground railway network covers an area stretching from its northernmost point, at Ongar, to Morden in the south, and from Amersham in the west to Upminster in the east. It is represented schematically in LUL's Journey Planner, which is reproduced at Figure 2.1.

2.2. Construction of the network began in the 1860s, and on 10 January 1863 the first underground railway in the world commenced operations when the then Metropolitan Railway opened a line between Paddington and Farringdon. Specially designed steam locomotives provided the earliest, or `sub-surface', underground services running through tunnels constructed by the `cut and cover' method, whereby cuttings were excavated, then roofed over and the surface restored, often with a roadway. A brief history of the development of the present Metropolitan Line is provided in Appendix 2.1.

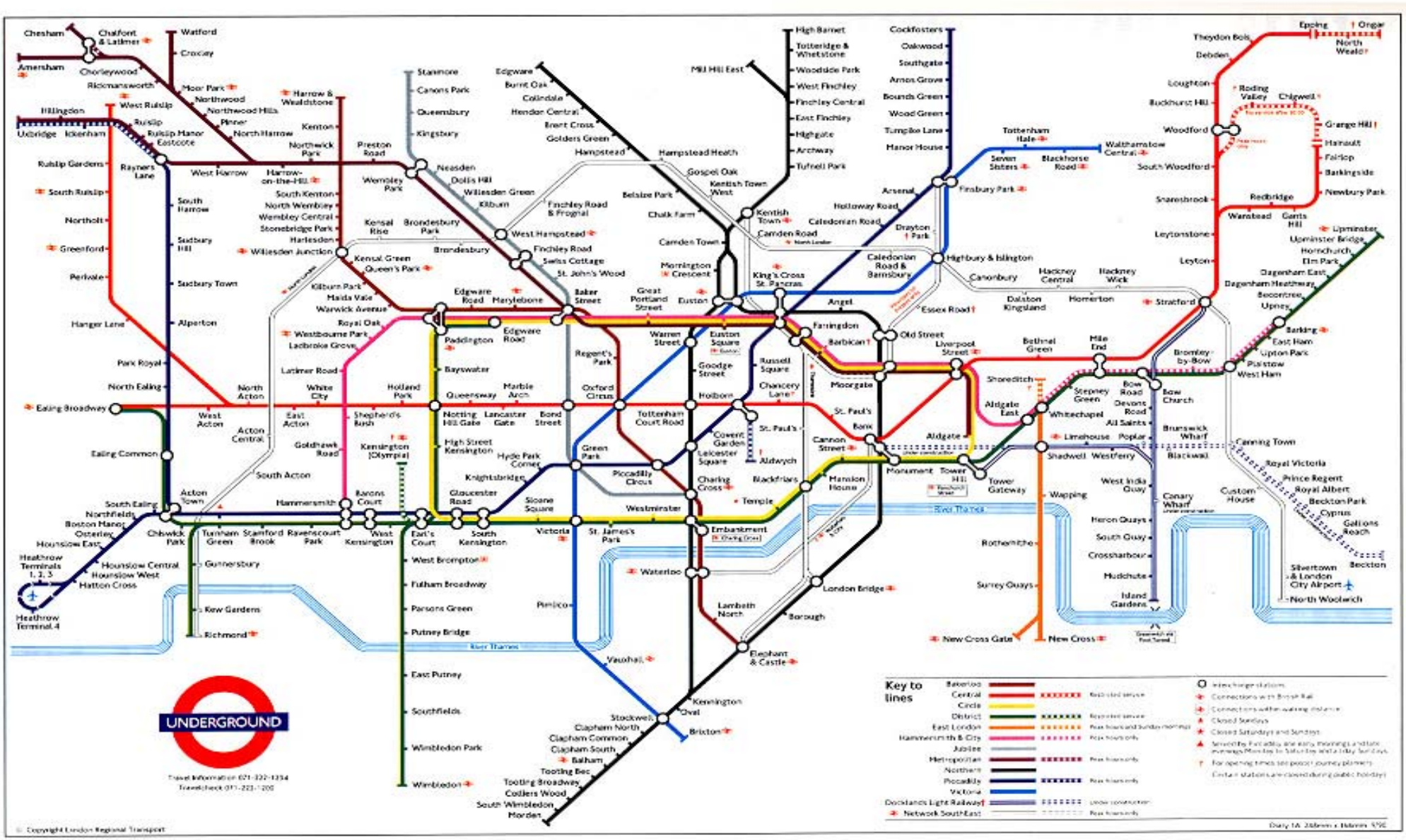
2.3. Electrification came to the Underground in 1890 with the opening of the City and South London Railway, the world's first `tube' line, now part of the Northern (via Bank) Line. Deep level tube tunnels capitalised on the introduction of electric traction and overcame the surface disruption of the cut and cover method whilst avoiding water mains, sewers and other underground services. Other tube lines followed, notably the then Central London Railway in 1900, which became London's first tube rapid transit railway when, after three years of operation, the introduction of multiple-unit traction (providing a driver's cab at each end of each train) eliminated locomotive changing at termini. A brief history of the development of the present Central Line is provided in Appendix 2.1.

2.4. The Underground railway (and bus) services in what is now the Greater London area passed into public ownership with the appointment of the London Passenger Transport Board (LPTB) in 1933. Thereupon the name `London Transport' appeared on trains and buses for the first time, and a new works programme (1935 to 1940) was begun, involving both the construction of new routes and the acquisition of new rolling stock.

2.5. After the Second World War the principal event was the phased opening between 1968 and 1971 of the Victoria Line, which is so far unique on the LUL network both in being all in tunnel (apart from its depot) and in being equipped for Automatic Train Operation (ATO), though ATO is soon to be introduced to the Central Line (see Appendix 2.1). In 1970, when political control passed to the former Greater London Council (GLC), the London Transport Executive (LTE), originally formed in 1948, was revived and continued in being until control reverted to the Government in 1984 (see paragraph 2.8).

2.6. A brief description of the present LUL system and its assets as a whole is provided at the beginning of Chapter 8. As well as being the oldest underground railway system in the world it has evolved as one of the largest and most complex. The most heavily used areas are almost entirely at deep level, where the narrow diameter tunnels are served by tube stock trains which are amongst the smallest in the world. Recently the Underground has experienced a huge growth in demand for its services (see Chapter 9) and it now plays, more than ever before, a pivotal role in the economic and social structure of London.

FIGURE 2.1
LUL's Journey Planner



Source: LUL.

Safety

2.7. LUL told us that safety had always been a major management concern. However, following the King's Cross fire in November 1987, in which 31 people lost their lives, and arising from the subsequent public inquiry, LUL had made major changes which had had far-reaching effects on all areas of its activity. Appendix 2.2 describes the measures taken to improve safety on the Underground in the past three years or so. Frequent reference to this appendix is made throughout our report.

Statutory framework

2.8. LRT, the parent company of LUL, was established as the successor to the LTE on 29 June 1984, under section 1 of the London Regional Transport Act 1984 (the LRT Act). LRT is charged with a general duty under section 2(1) of the LRT Act:

> in accordance with principles from time to time approved by the Secretary of State [for Transport] and in conjunction with the [British] Railways Board, to provide or secure the provision of public passenger transport services for Greater London.

2.9. In discharging this general duty LRT is required, under section 2(2) of the LRT Act, to have due regard to the transport needs for the time being of Greater London and to efficiency, economy and safety of operation. Under section 2(5) the same general duty is made subject to a further duty that LRT should do its best to ensure that its revenues (including grant) are `not less than sufficient to meet ... charges properly chargeable to revenue account, taking one year with another', as laid down in section 15; and to a duty to conduct its affairs with a view to achieving any financial objectives determined for it by the Secretary of State under section 16.

2.10. The Secretary of State has a variety of powers in relation to LRT. He appoints the members of the LRT Board. In consultation with HMT he determines an annual EFL and a capital investment limit for LRT. He also pays grant to LRT and may make loans to it from the National Loans Fund, though hitherto no such loans have been made.

2.11. Under section 4 of the LRT Act, LRT was required to create operating subsidiaries as limited liability companies to provide bus and rail services. It also has various powers to delegate functions to these subsidiaries and duties to control their activities. LUL is, accordingly, a wholly-owned subsidiary of LRT. It was incorporated as a registered limited liability company on 29 March 1985 and as such is governed by the provisions of the Companies Acts. The LUL Board is appointed by, and answerable to, the LRT Board. Similarly LUL has no direct relationship with the Secretary of State and its EFL and grant are determined and provided by LRT; however, grant which is `ring-fenced', such as that paid towards the extension of LUL's Jubilee Line, is effectively available only to LUL. Functions which LRT has delegated not to LUL but to other subsidiaries or Management Boards include the management of its property portfolio and the sale of advertising space (see Chapter 13).

2.12. In addition there are some important decisions which fall to the LRT Board because of their implications for a range of operating subsidiaries. In particular LRT is required by section 8 of the LRT Act to exercise control over its subsidiaries so as to determine the general level and structure of fares and other charges, as well as the general structure of routes and frequency of services. LUL told us that in practice the overall level and structure of fares had been subject to firm guidance from the Secretary of State.

2.13. The incorporation of LUL under the Companies Acts was approved by the Secretary of State. Assets were transferred to it from LRT on 30 March 1985 (see paragraph 13.4) and trading commenced on 1 April 1985.

2.14. Other statutes binding LUL include those applying to Railway Companies generally, such as the Offices, Shops and Railways Premises Act 1963, Railways Acts, Fire Precautions Acts and Health and Safety at Work legislation; and specific London Transport Acts dealing, for example, with enabling powers for new lines and pension funds. Appendix 2.2, in addition, gives details of the Fire Precautions (Sub-

Surface Railways) Regulations 1989 made under the Fire Precautions Act 1971. Enforcement of specific statutory safety requirements under the general body of rail safety and health and safety legislation is undertaken by the Railway Inspectorate on behalf of the Secretaries of State for Transport (in respect of passenger safety) and Employment (in respect of employee safety).

Control of LUL by LRT

2.15. Initial Directions were issued by LRT to LUL with effect from 1 April 1985 in pursuance of section 33 of the LRT Act which lay on LRT the duty of ensuring that its subsidiaries do not engage in activities which LRT itself cannot undertake. From time to time LRT also issues Standing Orders to LUL. Reference has been made already to LRT's appointment of LUL's directors and to the financial objectives set for LRT by the Secretary of State. The LRT Board Member for Finance has a functional responsibility to ensure that each subsidiary has adequate financial controls and adequate systems of financial reporting. LUL's annual budgets and business plans are subject to review and approval by the LRT Board; LUL's four-weekly results are reported to the LRT Board through the Managing Director's Report; and projects involving expenditure over £5 million require the LRT Board's approval. In formulating policies and plans for the overall conduct of business and investment proposals the LUL Board is also required to seek the LRT Board's approval. LRT has a duty to advise and to seek the approval of the Secretary of State in specific areas, for example in relation to investment proposals involving expenditure over £10 million.

3 Management and organisation, and planning

Introduction

3.1. In this chapter we describe the relationship between LRT and LUL, the structure of the LUL Board and Executive Committee and developments in the LUL organisation structure since 1984. We then examine the current LUL organisation structure covering the central directorates, the line businesses and relationships between them. Finally we examine the medium- and longer-term planning arrangements in LUL.

Management and organisation

Functions and management of LRT

3.2. LRT was established as a statutory corporation by the LRT Act (see paragraph 2.8). Since inception it has set up a number of wholly-owned subsidiaries including LUL, LBL and DLR. There are also some trading and specialist activities, including LTA and LTP (see Chapter 13).

3.3. The LRT Board comprises a full-time Chairman and Chief Executive, who is also Chairman of LUL, a part-time Vice-Chairman, a full-time Deputy Chief Executive, who is also Chairman of LBL, a full-time Member for Finance, who is also a non-executive director of LUL, and seven non-executive directors. LRT is responsible to the Secretary of State for Transport, with a duty to provide or secure the provision of public passenger transport services for Greater London.

3.4. In July 1984 the Secretary of State set a number of objectives for LRT which emphasised financial and quality aspects. Among other things LRT was required to:

(a) improve services for London within the resources available;

(b) reduce costs, including fraud and the call on taxpayers' and ratepayers' money, and generally secure better value for the community;

(c) submit an investment programme to modernise the public transport systems;

(d) bring forward investments which would save costs and improve passenger facilities; and

(e) reduce the present (1984) excessive call on ratepayers and taxpayers for revenue support.

3.5. The prime financial target set for LRT at this stage was to reduce the level of revenue support to £95 million in cash terms by 1987/88. This represented a 50 per cent reduction in cash terms over a three-year period and a greater reduction in real terms. Given these objectives the policy of LRT was to develop market strategies, including fares policies and structures, which would promote maximum use of the services within the financial resources available and be cost-effective in all aspects of the services provided.

3.6. LRT is responsible for co-ordinating matters such as planning, fares policy and allocation of joint income (eg Travelcards) between LUL and its fellow subsidiaries, LBL and DLR. Through LTA it sells advertising space on LUL and DLR trains and stations and on buses. LTP manages and develops the

extensive property assets of LRT and its subsidiaries and acquires land for public transport use. It also disposes of assets surplus to the operational requirements of LRT's subsidiaries.

3.7. As the parent company LRT monitors the performance of its subsidiaries on a periodic basis. In the case of LUL, performance reports are required in respect of service, finance and safety. The Secretary of State has set performance targets in a number of areas of LUL activity (see Chapter 14) and achievement against these targets is reported to LRT quarterly.

3.8. Financial performance is reported to LRT for each (four-weekly) financial period. This report gives performance and results in the management accounts plus statistics relating to train miles operated; costs per train mile; passenger miles and journeys; and service quality. A quarterly Internal Audit Report is also submitted to LRT covering the main issues arising from Audit Reports for the period.

3.9. A four-weekly safety report is made, supplemented by a quarterly report to the LRT Safety Audit Committee. These reports cover such issues as work currently being undertaken by LUL's Safety Services Department, progress on the achievement of safety services objectives, noteworthy incidents and statistical data for the period. In addition, LUL submits a quarterly report on progress in implementing the recommendations of the Fennell Report (see Appendix 2.2).

3.10. LRT's annual business and investment planning cycle (see paragraph 3.69 and Chapter 4) requires LUL's consolidated plans for the forthcoming budget year, and a further five `plan' years to be submitted to LRT in the January preceding the start of the budget year.

The LUL Board

3.11. The LUL Board comprises a Chairman (who is the full-time Chairman and Chief Executive of LRT), three full-time executive directors and four part-time non-executive directors. The executive directors are the Managing Director, the Engineering Director and the Finance Director/Company Secretary. Of the non-executive directors, one is the Member for Finance of the LRT Board while another has a special role in relation to safety matters.

3.12. Meetings of the Board take place every four weeks. In addition, meetings may be held at other times on the instructions of the Chairman or, in his absence, at the request of any other director. Other persons attend meetings of the Board as necessary and as directed by the Chairman. The Assistant Company Secretary acts as secretary to all Board meetings.

3.13. LRT Standing Orders require the LUL Board to approve a number of matters before submission to the appropriate LRT committee. They include:

(a) annual budgets;

(b) strategic plans for LUL;

(c) annual reports and accounts;

(d) all projects, including property purchase, lease or disposal, estimated to cost over £5 million;

(e) proposals materially affecting the policies and corporate aims of LUL;

(f) proposals to make material alterations to fares, services or service levels; and

(g) such financial and management progress reports as may from time to time be specified (see paragraphs 3.7 to 3.9).

3.14. The LUL Board has three committees:

(a) Executive Committee;

(b) Safety Committee; and

(c) Finance Committee.

The minutes of the Safety Committee are reviewed formally by the Board while the minutes of the other two are circulated to Board members for information so that points can be raised as necessary at Board meetings.

3.15. The role and composition of the Executive Committee is described in paragraphs 3.18 and 3.19. As noted in paragraph 3.11, one non-executive director has a special role in relation to safety matters and he is the Chairman of the Safety Committee. Other members include the Managing Director, the Engineering Director and five named senior managers. In addition, two General Managers (line businesses) and one Engineering Manager are invited to attend, nominated for one- year terms on a rotating basis.

3.16. The role and functions of the Safety Committee, which normally meets every four weeks, are set out in Appendix 3.1. To assist further in the management of safety LUL has also established a Safety Management Group, chaired by the Managing Director. The terms of reference for this group are at Appendix 3.2.

3.17. The terms of reference for the Finance Committee, which normally meets every two weeks, are at Appendix 3.3. Membership comprises one non-executive director, who currently chairs the committee, the Finance Director/Company Secretary, the Engineering Director and four senior managers of LUL, plus one from LRT.

The Executive Committee

3.18. The Executive Committee is the senior management group of LUL responsible for day-to-day control. It comprises the Managing Director as Chairman, the two other executive directors, five directors who are not Board members and two senior managers. The Assistant Company Secretary acts as secretary to the committee and other persons attend meetings as necessary. Meetings are held weekly or as directed by the Chairman of the committee.

3.19. As can be seen from the terms of reference, shown at Appendix 3.4, the Executive Committee covers the full range of LUL's activities. A chart showing the senior management structure of LUL is at Appendix 3.5, which also indicates members of the LUL Board and members of the Executive Committee.

Developments since 1984

3.20. The LRT Act required LRT to create subsidiary operating companies and LUL was incorporated as a wholly-owned subsidiary on 29 March 1985 (see paragraph 2.11). A review of the organisation led to the introduction of `client' and `internal contractor' relationships in LUL. The primary purpose of the distinction drawn between `client' and `internal contractor' was to create commercial discipline between one part of LUL which wanted a particular product or service (the client) and another part which would supply it (the internal contractor). In certain activities, the existence of a more formal buyer/seller relationship would enable the buyer to seek supplies or services from outside LUL, thereby facilitating competitive tendering as required by the LRT Act. In April 1986 the engineering functions were reorganised with the Engineering Director (the client) becoming responsible for stewardship of the assets, including design, standards and quality. A General Manager (now Director) of Engineering Operations was appointed to be responsible for the internal contractor workforce other than for rolling stock maintenance.

3.21. In mid-1987 the LUL Board authorised a major strategic review of LUL including structure and organisation. The results of this review were influenced by the King's Cross fire (November 1987) and the subsequent Fennell Report. However, LUL told us that these were not the only reasons for the changes introduced, particularly the creation of line businesses. The major reorganisation took place in November 1988 with a restructuring of the LUL Board, the establishment of ten line businesses and some changes in central directorates.

3.22. Rolling stock maintenance and overhaul work was already the responsibility of the former Operations Directorate following the Acton Works study. After November 1988 these activities became a line-based responsibility while the new Equipment Overhaul Workshop (EOW) at Acton continued to carry out equipment overhaul.

3.23. As a further development of this approach, the LUL Board has now approved the devolution of day-to-day and routine maintenance on permanent way and signalling to the line businesses. The reasoning behind this change is that day-to-day and routine maintenance of permanent way and signalling, like rolling stock, is considered an essential part of the core business. All engineering maintenance work was previously considered as non-core business and therefore eligible for external competitive tendering as required by the LRT Act.

3.24. Due for full implementation by April 1992 this change is currently subject to review as part of a value analysis project started in December 1990. However, the change is expected to be achieved with no overall increase in manpower numbers. It will involve the transfer of about half the present permanent way staff and one-third of signal and electrical staff from engineering operations to the line businesses. In addition some staff will be transferred from the Engineering Directorate.

The present structure

3.25. As shown in Appendix 3.5, the current Headquarters structure of LUL comprises seven directorates and six other departments. The heads of all 13 report directly to the Managing Director and all but four of them are members of the Executive Committee. The roles of the various directorates and departments are described in the following paragraphs.

Passenger Services Director

3.26. The Passenger Services Director is responsible for the delivery of all train and station services to the customer to meet performance targets for quality, safety, volume and financial performance. He is responsible for the rapid resolution of service problems, and for developing and implementing operational policies, and is the chief incident manager. These responsibilities are discharged through the Line General Managers (LGMs) of the ten line businesses who report to him (see paragraph 3.21). A Passenger Services Support Manager also reports to him.

3.27. The Passenger Services Director controls just over 60 per cent of total LUL staff, or some 12,900 people as at November 1990. Of these, 568 are under his central control while the great majority are in the ten line businesses. Among the 568 central staff, the two largest groups are the Passenger Services Support Unit (260 people) and the Engineers' Train Unit (277 people).

Development Director

3.28. Responsible for the development of the network and services, the Development Director has five managers reporting to him, covering operational development, train service development, network planning and operations liaison; one of the managers is responsible for support services to the directorate. As at November 1990 the directorate had 174 staff.

Engineering Director

3.29. With 12 senior engineers/managers reporting to him, the Engineering Director is responsible for 2,468 staff plus 554 temporary or consultant staff (as at November 1990). His directorate is broadly divided into three groups: client engineers, professional services and support. Also included are the Power and Electrical Engineer and the Head of Information Technology (IT).

3.30. As noted in paragraph 3.20, the client engineers are responsible for stewardship of the assets, including design, standards and quality. With the exception of rolling stock engineering, they control maintenance and renewal budgets and arrange contracts for the necessary work to be undertaken by internal or external contractors. There are six client engineers responsible for lifts and escalators, signalling and control systems, rolling stock, civil engineering and the UTS. They had a total of 522 staff plus 73 temporary or consultant staff. The Power and Electrical Engineer, also included in this group by LUL, had 539 staff plus eight temporary staff.

3.31. The largest of the three groups in staff terms, with 1,017 staff and 413 temporary or consultant staff, the Professional Services Group (PSG) is effectively an in-house engineering consultancy providing services on a re-charge basis. Much of the PSG's work is concerned with providing project management for LUL's investment programme (see Chapters 11 and 12), but it also provides technical expertise for `design, problem solving and development work'.

3.32. The support group had 390 staff plus 60 temporary or consultant staff. Included in this group are five senior managers with responsibility for procurement, engineering safety and hazards, information technology, finance (engineering) and personnel (engineering).

Director of Engineering Operations

3.33. The Engineering Operations Directorate provides the internal contractor workforce for all engineering work except rolling stock maintenance. It had a total workforce of 5,454 staff, with a further 29 temporary or consultant staff.

3.34. A total of 11 senior managers report to the director, including a finance manager, a personnel manager, three workshop managers (permanent way, signal overhaul and equipment overhaul), three managers who control workforces providing on-site engineering maintenance (permanent way, signal and electrical, and lifts and escalators), one manager who provides support for depot engineering, one who controls distribution services and one who manages cleaning services.

3.35. The roles, relationships and activities of both engineering directorates are considered in more detail in Chapter 8.

Finance Director/Company Secretary

3.36. There are five senior managers reporting to the Finance Director/Company Secretary, including the Head of Internal Audit and the Assistant Company Secretary. The role and size of the directorate is fully detailed in Chapter 4.

Marketing Director

3.37. The smallest of the directorates in staff terms, with 91 staff, the Marketing Directorate has five senior managers. They are responsible for marketing, advertising and publicity, property development, design and customer programmes.

Personnel Director

3.38. Six senior managers report to the Personnel Director, covering industrial relations, personnel, training and development matters. The role and size of the directorate is described in Chapter 6.

Other Headquarters departments

3.39. Of the six other departmental heads who report to the Managing Director, the recently appointed Head of Safety Services and the Head of Public Relations are members of the Executive Committee. The Head of Safety Services, who is also a member of the Safety Committee, has 38 staff with five senior managers. The establishment of the Safety Services Department, and its particular responsibilities, are described in Appendix 2.2.

3.40. The Head of Public Relations has 21 staff organised into two sections, dealing with press and promotions and public affairs including customer relations. Apart from the Assistant Chief Constable (British Transport Police) with 437 staff, the other departments are small specialist units, for example eight staff in Strategic Planning.

Line businesses

3.41. The creation of ten line businesses was a major part of the November 1988 reorganisation. Based on LUL's well-known network of lines, the businesses range in staff terms from 164 (East London Line) to 2,354 (Northern Line).

3.42. The basic organisation of the ten line businesses is very similar. Each LGM has from six to eight managers reporting to him:

(a) a Train Service Manager, responsible for the day-to-day operation of the service including train crew and signal and control staff;

(b) a Fleet Manager, responsible for rolling stock maintenance and overhaul including direct management of the main or only depot on the line; support is provided by a Depot Manager where there is a second depot (eg Central Line);

(c) one or more Business Managers, responsible for station operations and revenue protection. A line business may have from one to three Business Managers, depending on size and workload; for example, the Metropolitan has two while the Central and District both have three. Apart from the management of stations and related staff, the Business Managers have a general remit to promote additional revenue through any appropriate means, such as encouraging off-peak travel or securing advertising or rental income;

(d) an Engineering Services Manager, at present responsible for liaising with the Engineering and Engineering Operations Directorates on all engineering matters affecting the line except rolling stock maintenance;

(e) a Finance and Planning Manager (see Chapter 4); and

(f) a Personnel and IR Manager (see Chapter 6).

These managers are in turn supported by `centurion' and duty managers.

3.43. As a direct result of the King's Cross fire and subsequent criticisms of management in the Fennell Report, LUL introduced the concept of `centurion' managers. The Fennell Report commented that the duty shift manager arrangements of the time resulted in most staff at operating level not having a regular, identifiable manager at an appropriate level and location. LUL therefore introduced an additional level of managers, known as centurions, responsible for up to 100 staff and who would remain responsible for that group of staff regardless of shift-working patterns.

3.44. Because it mainly affects operating staff the need for centurion managers is largely confined to the line businesses. As an example, the Central Line has some 720 train crew based in five depots. To manage these it has eight train crew managers (centurions) and 32 duty crew managers (shift working). For station staff the centurion is a Group Station Manager who may be responsible for one large station (such as Oxford Circus) or up to seven small ones. The Business Manager for Central Line (East) has 20 stations and four Group Station Managers each with from 65 to 80 staff. Again duty managers provide shift cover throughout the operating day. The Central Line has one centurion manager for signal and control staff plus three duty operations managers.

3.45. The Central Line is one of only two lines now carrying guards, hence the large number of train crew. In contrast the Metropolitan Line, with OPO trains, has only 259 train crew, who are based in three depots with four centurion managers-two at Neasden depot, with 186 staff. However, the Metropolitan has a more extensive signalling and control system than the Central and has two centurion managers for signal and control staff. The Metropolitan has a total of seven centurion Group Station Managers.

3.46. In technical matters of common interest to the line businesses it is now the practice for one line to take the lead on behalf of all ten in dealings with the centre. For example, the Engineering Services Manager of one line represents the views of his nine colleagues rather than all ten acting separately. This does, of course, require periodic meetings between the ten to establish a common view.

3.47. The LGMs' specific responsibilities are set out in Appendix 3.6. There are limits to the freedom of action of a line business where corporate interests are overriding. In particular, fares policy and levels are controlled centrally, as is the choice of ticketing equipment; so too are many personnel and industrial relations matters. Until recently the line businesses have not been treated as the client in any capital project, be it a line modernisation or a station upgrading project: thus the Central Line is not the client for the Central Line Project. However, LUL told us that in the future the line businesses would have a greater involvement in new projects.

Planning

External influences

3.48. The pivotal role of the Underground within London's transport system requires that LUL's planning should not take place in isolation and that LUL's objectives should extend wider than simple profit maximisation. Both these points are recognised in the transport planning framework established by DTp. Unlike a normal commercial enterprise LUL has in recent years been constrained to carry out much of its formal strategic planning in the form of external joint exercises. The larger the strategic decision concerned, and the longer the time-scale, the more this has been the case.

Central London and East London Rail Studies

3.49. Responsibility for bringing forward proposals for transport schemes rests with LRT. Such proposals may be called in by DTp for Ministerial approval. However, because of the need to address problems of national significance, the Central London Rail Study (CLRS) and the East London Rail Study (ELRS) were, exceptionally, set up as joint studies. CLRS was set up in 1988 as a joint LRT/NSE[1]/DTp exercise and ELRS in 1989 as a joint LRT/DTp exercise.

3.50. Both studies made recommendations to the Secretary of State. The aims of CLRS were to develop a strategy for improving services and providing for the renewed upsurge in the demand for radial travel into Central London and for rail travel within Central London. CLRS had particular regard for the need to make the best use of existing assets, and focused on planning the upgrading and extension of the LUL and NSE networks to reduce peak-hour congestion in the central area.

---

[1] Network SouthEast.

3.51. The CLRS recommendations were, firstly, that a Major Upgrading Programme (MUP), including LUL congestion relief projects, costing £780 million should be implemented to maximise the capacity of the existing network. In addition numerous options for new lines or major extensions of existing lines were considered. Two new lines were recommended, with several preferred options being identified, and in October 1990 the Secretary of State gave the go-ahead for the East-West Crossrail, with a view to the deposit of a Private Bill in November 1991. At the same time he announced that the alignment for the second new line, the Chelsea-Hackney Line, was also to be safeguarded for future implementation. Ring-fenced finance[1] is being provided for the East-West Crossrail. Such finance is regarded by DTp as being additional to any finance that LUL might otherwise receive and as justified by criteria such as the effect of the project on the future development of London.

3.52. ELRS was established to examine the best options for improving rail access from Central London to Docklands and East Thames-side. It recommended that the Jubilee Line should be extended from Green Park via Waterloo, London Bridge and Canary Wharf to Stratford. The Secretary of State approved the project in November 1989, when he authorised LRT to deposit a Bill for the extension and ring-fenced finance is being provided. The London Chamber of Commerce and Industry (LCCI), the four London boroughs which expressed a view on these matters and the Association of London Authorities (ALA) told us that they fully supported the CLRS recommendations; two of the boroughs particularly welcomed the Jubilee Line extension.

The London Assessment Studies

3.53. LUL's strategy is also influenced by formal planning exercises in which it is not directly represented. In parallel with CLRS and ELRS, the Heathrow and South West Quadrant Study and a series of London Assessment Studies (LAS) were commissioned by DTp from transport consultants. LAS asked the consultants to examine four parts of London outside the central area which were affected by serious traffic congestion. LAS had the main objectives of promoting accessibility, supporting employment and economic growth and improving the environment in these parts of London. Although it was anticipated that LAS would be mainly concerned with proposals for road building, the Secretary of State rejected the major road-building proposals, leaving modest improvement proposals for the roads and a series of major public transport proposals for further consideration.

3.54. As a result, the Secretary of State has asked LUL to give further consideration to the case for the extension of the East London Line to Dalston and Highbury, and to East Dulwich, and for the extension of the Northern Line from Kennington to Streatham and Crystal Palace.

Objectives

3.55. Section 2 of the LRT Act sets out the main duties of LRT and thus of LUL. So far as they concern LUL these duties are summarised below:

(a) in conjunction with British Rail (BR) to provide or secure the provision of public passenger transport services for Greater London in accordance with principles approved by the Secretary of State;

(b) to have due regard for the transport needs of Greater London and for efficiency, economy and safety of operation;

[1]Ring-fenced finance is that part of LRT's EFL which is granted for specific purposes and can only be used for those purposes. Expenditure on ring-fenced projects is reported separately to DTp.

(c) to co-operate with BR in co-ordinating LRT and BR passenger services and in exchanging information; and

(d) to seek to achieve any financial objectives set by the Secretary of State (see paragraph 4.3).

Since these duties are of a general nature they are supplemented by more specific targets and guidance.

3.56. Comparing the various strategic planning and transport planning exercises involving LUL with LUL's internal planning processes reveals a variety of objectives:

- meeting DTp financial and quality of service targets (LUL internal planning);
- reducing congestion on central area trains (CLRS);
- improving access to Docklands and enabling redevelopment to take place (ELRS);
- improving access to parts of inner and outer London, supporting economic growth and relieving congestion on the road network (LAS); and
- maximising passenger benefits (and sometimes external benefits) subject to satisfactory cost benefit ratios (LUL project appraisal).

3.57. ALA expressed to us the view that it was essential for London to have an effective, efficient rail service, particularly with respect to the development of London's economy. It was not appropriate to consider the costs and services provided by LUL in isolation from other forms of transport. The Government should provide broader objectives for LUL as part of a strategy for transport in London as a whole. ALA criticised the objectives set out by the Secretary of State for Transport in *Transport in London*.[1] The National Council for Inland Transport (NCIT) said that there was an urgent need for a strategic planning structure to be established for London which, whilst keeping the various operators separate and in competition, would co-ordinate regional investment planning and fares structures.

Planning horizon

3.58. A common feature of the options for new lines considered in the major strategic studies above is the very long gestation period from the initial proposal to the expected completion of the line. CLRS began in 1988 and resulted in decisions in favour of the East-West Crossrail and the Chelsea-Hackney Line. LUL expects to deposit a Parliamentary Bill for the former in November 1991 and this Bill is likely to take 18 months to two years to achieve. Construction of the project would then take five to six years, resulting in a total period of about 25 years from its initial consideration in the London Rail Study of 1974 to the opening of the line. The Chelsea-Hackney Line could then follow perhaps two years later, resulting in completion in the first decade of the next century. This project is also closely related to proposals considered in the 1974 London Rail Study.

3.59. Given these long lead times LUL and LRT now intend to extend their planning horizon beyond the present five- to ten-year period and to consider an outline transport strategy over a ten- to 20-year period.

Strategic planning in LUL

3.60. LUL's basic internal strategic document is its Strategic Plan. The current LUL Strategic Plan dates from 1988. Although reviewed regularly, a new Strategic Plan is prepared only when it is felt that there is a need for a change of direction.

---

[1] *Transport in London*, the Department of Transport, 1989.

3.61. LUL inherited a 1983 Strategic Plan from the GLC era. This document was prepared against a background of falling passenger demand and set out a programme for upgrading the quality and efficiency of the network by investing heavily in high technology. Proposals for introducing ATO on the Central and Northern Lines were included but in view of the static market that was then anticipated there was no provision for new lines or significant increases in capacity.

3.62. When LUL carried out its first review of the Strategic Plan in June 1988 its view of the world had changed entirely, following six years of growth which were unprecedented in the previous 40 years. The 1988 Strategic Plan was carried out concurrently with CLRS and the Fennell Inquiry and included a broad-brush analysis of LUL's market and its internal business operations. It presented the basic strategic choices without filling these out (which was left for later more detailed plans) and moved from a businesslike analysis of the issues facing LUL in 1988, through four strategic options, to a preferred strategy with three five-year phases.

3.63. The first phase of the preferred strategy (up to 1992/93) relied on early and substantial fares increases above the rate of inflation to tackle congestion, quality and safety problems and to provide finance for later investment. This phase also included action to upgrade LUL's management and to adopt a more commercial corporate culture, and it emphasised investment in safety, quality and congestion relief. Investment programmes already under way were to be continued and further refurbishment and renewal of stations was to be carried out. Major investment in additional capacity was to include the extension of the East London Line and enhanced service levels on the Northern Line.

3.64. The second five-year phase of the strategy included the Central Line Project, the modernisation of the Northern Line and its extension to Brixton and further upgrading schemes at key pinch points in the system.

3.65. The third phase of the strategy included new lines and extensions (dependent on the outcome of CLRS), the Jubilee Line extension and a rationalisation of lines in West London.

3.66. LUL's intention in the 1988 Strategic Plan was to develop a business strategy rather than a transport strategy. The transport strategy was examined separately in CLRS and ELRS at about this time. The Strategic Plan was based on a strong analysis of LUL's business position and the robustness of the preferred strategy to alternative demand scenarios. It did not, however, consider the effect of LUL's preferred strategy on the overall transport problems of London and was not formally submitted to DTp for approval. Consequently it did not assess whether the preferred strategy was likely to be politically acceptable, or what other measures might be required to make it politically acceptable.

3.67. In practice the significant `real' fares increases required by the strategy were not subsequently approved by the Secretary of State, leaving LUL with no fall-back position for the first phase of its preferred strategy. As a result LUL is essentially seeking to carry out the first phase of the strategy without its core component. The problem of congestion remains very severe and in the absence of real fares increases no internal resources are generated to provide limited finance towards upgrading the system. This severely constrains LUL and extends the time-scales for implementing the strategy.

3.68. One London borough commented that LUL's business strategy was too geared towards short-term financial objectives. As a result, planning for customer needs had suffered and management was not geared to meeting any reasonably defined transport objectives.

The 1990/91 Budget and Five-Year Business Plan

3.69. LUL operates a one-year formal planning cycle. This cycle includes the preparation of the budget for the next financial year, a business plan for the following five years and the UIP, which includes the business plan years together with a summary of the following five years. The preparation of these plans has traditionally been a `top-down' exercise. Following the adoption of the line business approach, the line management teams now also produce their own business plans, so adding a `bottom-up' element to the process. At the moment the top-down element still dominates and the line business plans are essentially bids for central resources. The LUL Budget and Five-Year Business Plan (the Business Plan) is the main

internal planning document and combines the detailed operating budget for the first year with the investment programme for the later years. The business planning process for the period 1991/92 to 1996/97 started in August 1990 (see paragraph 4.23). The preparation of the UIP is considered in detail in Chapter 11.

3.70. The 1990/91 Business Plan was prepared when LUL's management was under especially severe pressure. The introduction sets out the traumas of the previous year, which included:

- the implementation of the Fennell Report;
- the Railway Inspectorate Report (see Appendix 2.2);
- the new Fire Precautions Regulations (see Appendix 2.2);
- industrial relations problems and consequent disruption of services; and
- the turning down by DTp of proposed fares increases.

As a result of these pressures, and the EFL settlement, LUL found itself under severe short-term financial and operating constraints.

3.71. Although LUL still aspired to the implementation of the first phase of the 1988 Strategic Plan, the short-term constraints would prevent this. The most drastic result was severe capital rationing which necessitated the prioritisation of the investment programme and the exclusion of non-essential projects (see Chapter 11). Priority was given to safety projects and urgent asset renewal, with lower priority being given to congestion relief, passenger benefits and increases in capacity. This resulted in a divergence in approach between the two CLRS projects and the remainder of the investment programme.

3.72. The CLRS projects and the Jubilee Line extension had ring-fenced finance. They were therefore protected in the 1990/91 Business Plan, although the case for them relied on low priority criteria such as congestion relief and customer benefits. Other projects within LUL's investment programme, excluding the Central Line and Northern Line Projects, were normally only to proceed if the case for them was justified on the grounds of safety or essential asset health. This, therefore, affected the MUP projects which, although a high priority within CLRS, were not protected by ring-fenced finance.

3.73. Despite the financial constraints and the urgent safety measures which now had to take top priority, the general approach remained that of the first phase of the 1988 Strategic Plan. Emphasis was given to safety, a change in corporate culture, real fares increases and achieving the quality of service targets that had been set by DTp. This was summed up in the PLEASE acronym mission statement:

- to be a key **P**artner in London's life and its continued prosperity;
- to become once again a **L**eader in the world's underground networks;
- to provide customers with an **E**njoyable travel experience, and a similar work experience for employees;
- to provide good services **A**ffordable to Londoners and visitors;
- to ensure that services are **S**afe for customers and staff; and
- to be regarded by customers and shareholders as **E**fficient and to be satisfied that London Underground actually is.

Line business plans

3.74. Line business plans are a new concept within LUL. Some were prepared for the first time in 1990/91 (eg that for the Metropolitan Line) and some for the second time (eg that for the Central Line). The guidelines for the 1991 planning process requested a mandatory core of information, including budget documents, in a common format. Other than that, LUL considered that there would be no advantage to efficient business planning in having identical formats. It was considered that the accountable managers should be allowed the freedom to address the issues in a manner that reflected the different challenges and problems facing each business unit. Despite the central guidelines there is a wide divergence in the resulting style and content.

3.75. The Central Line Business Plan is a very detailed plan largely focused on the way that the Central Line Project (and related expenditure) should be implemented. Expenditure at the same location is grouped together more effectively than in the UIP, which is based on separate programmes for each type of asset. The plan also identifies significant expenditure which was excluded from the Central Line Project, eg track upgrading. The Central Line Business Plan could therefore result in the more efficient implementation of capital projects by avoiding the necessity for `digging up the road twice'. However, the plan is unrelated to the resources that are available and is essentially a bid. It cannot, therefore, be implemented but should guide and improve the quality of thought that is put into the Central Line's projects when the UIP is drawn up.

3.76. The Metropolitan Line Business Plan is different. It is concerned with changing the corporate culture of the Metropolitan Line and improving its management style. There is no consideration of investment projects as the Metropolitan Line has few projects within the UIP.

Conclusions and recommendations

Management structure

3.77. LUL underwent a major reorganisation in November 1988 following a strategic review of the business, the outcome of which was influenced by the King's Cross fire and subsequent Fennell Report. The new structure was designed to facilitate a more commercial approach, to reduce the number of management tiers and to meet the criticisms of undermanagement contained in the Fennell Report. One result of the restructuring has been to increase the managerial span of control at senior level. The Managing Director has 13 directors or senior managers reporting to him while three of the seven directors have 11 or more senior managers reporting to them. In subsequent chapters we draw attention to a number of matters where there has been insufficient, or no, follow-up by senior management, for example in respect of audit recommendations. We also note areas where responsibility and accountability are not clear. We conclude that such spans of control, at near double the accepted practice, are too wide for effective control.

3.78. We recommend that LUL should review the Headquarters structure with the aim of reducing the spans of control to below double figures. A start has been made, in the case of the Managing Director, as part of a value analysis review.

3.79. To meet the requirements of the LRT Act for competitive tendering, the engineering functions in LUL had been restructured in 1986 to introduce the concept of client and internal contractor. The Engineering Director is responsible for stewardship of the assets, including design, standards and quality, professional services and support services, while the Director of Engineering Operations is responsible for the internal contractor workforce except for rolling stock maintenance, which rests with the line businesses. We conclude that these arrangements have resulted in fragmentation of responsibility and duplication of effort, as LUL conceded is `probably' the case. Further we conclude that the system has resulted in LUL doing unnecessary business with itself.

3.80. We recommend that LUL should take steps to clarify responsibility and eliminate duplication, particularly in regard to core business activities, and that this should be done by October 1991.

3.81. The ten line businesses were created as part of the 1988 restructuring and are still being developed. LUL told us that it was unlikely that the line businesses could ever become full profit centres because of the problems of revenue allocation given the nature of the overall network and its use. Nevertheless, more responsibility for costs would be devolved to the line businesses over time and they would have full involvement in the design and specification of projects affecting their line. LUL told us that it would wish to set engineering and quality standards corporately, but that line businesses would be able to exercise commercial judgment in doing better than the corporate standards. We conclude that the present level of devolution to the line businesses is unsatisfactory, but that this is part of an evolutionary process. We accept LUL's assurance that the changes are being progressed as quickly as is sensible taking account of the abilities of the line businesses to absorb additional responsibilities.

Joint planning exercises

3.82. In recent years much of LUL's strategic planning has taken the form of its participation in joint transport planning exercises with LRT, NSE and DTp, most notably CLRS. In these exercises the overall transport planning of London has tended to take precedence over LUL's internal business strategy. DTp has informed us that each of the joint studies has been an exceptional case and that they should not be regarded as the norm for future planning by LUL. Nevertheless the resulting decisions will determine the core of LUL's investment plans for the next 15 years.

3.83. We conclude that this environment has made it difficult for LUL to develop a coherent business strategy which is consistent with overall transport policy, and ensures that LUL needs to be particularly sensitive to the effect of its business strategy on the overall transport problems of London. We therefore recommend that LUL, in conjunction with LRT, should devote more attention to reconciling its business strategy with other aspects of the overall transport strategy for London. This may require consultation with other public transport bodies followed by joint lobbying to establish a common view on the role of LRT, shared with the Government and the wider public.

3.84. The allocation of investment finance is heavily constrained by the existence of ring-fencing for the largest projects. As a result the overall allocation of investment finance to the CLRS projects, MUP projects and other UIP projects is no longer consistent with their relative priorities as perceived by LUL. DTp, however, regards ring-fenced projects, such as East-West Crossrail and the Jubilee Line extension, as being outside the normal LUL planning framework, assessed according to different criteria including their effect on the future development of London, and representing additional finance which would not otherwise have been available to LUL. Nevertheless we are concerned that MUP projects are being delayed.

Objectives

3.85. The various external strategic planning exercises which have determined a major part of LUL's strategy have a wide range of social benefit objectives. The internal objectives set for LUL are based on section 2 of the LRT Act supplemented by financial and quality of service targets. LUL's investment objectives are based on cost benefit analysis criteria including passenger benefits and external benefits.

3.86. We conclude that LUL is faced with conflicting objectives to an unusual degree. We therefore recommend that LUL, in conjunction with LRT, should put forward proposals to establish a clear framework of objectives for agreement by DTp by the end of 1991.

Strategic planning

3.87. LUL's current three-phase strategic plan was adopted internally in 1988. The first phase of this plan relied on early substantial real fares increases to tackle congestion, quality and safety problems and to provide finance for later investment. DTp has told us that the real fares increases in the plan were neither formally agreed by DTp at the time nor subsequently approved by the Secretary of State when LUL sought to implement them.

3.88. We conclude that, as one of LUL's critical underlying assumptions (fares levels) is now invalid, LUL's strategy is no longer fully effective. We therefore recommend that LUL should now prepare a new strategic plan and that it should seek firm political commitment to this plan. We also recommend that the plan should include a range of costed options covering levels of fares, investment and financing, and showing the implications of these for the quality of service and for the long-term development of London's overall transport system.

Business plans

3.89. Despite the introduction of line business plans the planning process is essentially top-down and centralised. The line business plans are bids for resources rather than plans to be implemented. We conclude that the bottom-up element of the planning process needs to be strengthened and made more realistic. We therefore recommend that the line business plans should become an integral part of the LUL Business Plan in the next annual planning cycle. Line proposals should then be drafted on the basis of general guidelines and realistic financing limits set from the centre. Similarly the analysis of the line programmes in the UIP should receive the same degree of emphasis as the analysis by engineering client programme.

3.90. The business plans prepared by the lines for 1990/91 show a wide variation in both style and content. This may indicate a lack of clarity about their purpose. We conclude that there is a need for a more standardised structure for line business plans. We therefore recommend that LUL should take steps to identify the best practice in the existing line business plans and to incorporate this within the central guidelines for future plans.

3.91. LUL's 1990/91 Business Plan was based on a substantial overestimate of the resources that would be available. This resulted in several rounds of cuts in the budget and largely invalidated the later years of the Business Plan. We conclude that LUL needs to adopt a more conservative approach in forecasting the resources that will be available in its planning. We therefore recommend that LUL should base the main case of its next Business Plan on a core level of financing in which it has a high level of confidence, and should include one or more higher cases with additional projects related to the scenarios being developed for the UIP (see paragraphs 11.77 and 11.78).

4 Financial framework and control

Introduction

4.1. In this chapter we first outline the regulatory financial framework, which is a necessary background to an understanding of the budgetary problems experienced by LUL in 1990/91 (paragraphs 4.2 to 4.9). In order to test the effectiveness of LUL's systems of financial control we then deal with the budget out-turn in 1990/91 and certain aspects of monitoring and control against budget (paragraphs 4.10 to 4.36). We go on to describe the LRT Cash Management Review and draw attention to problems relating to the starting financial position for 1991/92 (paragraphs 4.37 to 4.41). We then set out LUL's financial results and deal with other aspects of financial control (paragraphs 4.42 to 4.71). Finally we turn to the organisation of the finance function and certain audit matters (paragraphs 4.72 to 4.82).

The regulatory framework

4.2. LUL, a limited liability company incorporated under the Companies Acts on 29 March 1985, began trading on 1 April 1985.

4.3. It is a wholly-owned subsidiary of LRT and, as such, its directors are appointed by LRT. Its Chairman is also Chairman and Chief Executive of LRT.

4.4. LUL prepares its accounts in accordance with the Companies Acts. No other statutory financial limitations or obligations apply to it as such but it is also indirectly subject to the financial obligations imposed on LRT by section 15 of the LRT Act and in addition, under section 16 of the LRT Act, the Secretary of State for Transport may determine the financial objectives of LRT and hence, indirectly, of LUL.

4.5. LRT's financial obligations under section 15 are to:

(a) ensure that, so far as practicable, its revenues, including Government grant, when combined with that of any subsidiaries, should be not less than sufficient to meet their combined charges properly chargeable to revenue account, taking one accounting year with another; and

(b) charge to revenue account, and ensure that its subsidiaries charge to revenue account, all costs, including depreciation, which should be so charged.

4.6. LRT is a nationalised industry and as such is subject to the relevant financial controls. Over and above the statutory provisions already referred to:

(a) capital projects (in LUL's case only those estimated to cost more than £10 million) are subject to approval by the Secretary of State;

(b) borrowing limits have to be approved by the Secretary of State;

(c) guidance is given by the Secretary of State as to fares increases;

(d) LRT has to keep within an EFL fixed by the Government; and

(e) financial objectives are set by the Secretary of State.

LRT also receives grants from the Government under section 12 of the LRT Act and these are covered by the EFL. There are two types of grant:

(i) `grant in support of operations', equivalent to the difference between budgeted income and budgeted expenditure (including depreciation and renewals); and

(ii) `capital grant', intended to finance new investment less depreciation, proceeds from the sale or development of assets and any operating surplus for the year after allowing for the support grant.

LRT assigns the relevant proportion of these grants to LUL.

4.7. In April 1990 the Secretary of State fixed the following financial objective for LRT and included one for LUL. LRT's overall operating loss of £76 million in 1989/90 is to be transformed into an operating surplus of £70 million in 1992/93. LUL is clearly involved in making a contribution to that but additionally an improved efficiency target for reduced costs per train mile (excluding depreciation and renewals) of £14.02 was set (actual for 1989/90 was £14.50). The Secretary of State moreover made it clear that financial objectives were concerned with ensuring that the safety and quality of service objectives were met as efficiently as possible.

4.8. LRT has also set LUL a number of corporate aims including the improvement of internal accountability and the strengthening of financial management control to facilitate the development of management units with clear goals and measured objectives. LRT also agrees with LUL, after consultation, budget guidelines, annual budgets, targets, fares levels and financial performance. Capital projects estimated to cost in excess of £5 million also fall to be approved by LRT (and those over £10 million may require DTp approval as well).

4.9. Most importantly LRT has to allocate to LUL a proportion of the overall EFL which comprises:

(a) movement in liquid capital resource (ie cash and bank balances);

(b) borrowings within limits approved by the Secretary of State under section 18 of the LRT Act; and

(c) grants made under section 12 of the LRT Act.

The EFL is fixed for the ensuing financial year, with provisional figures for the two following years, called `guidelines'. (Allowances also have to be made to LBL, DLR and various other bodies and activities for which LRT is responsible.)

Out-turn against budget 1990/91

4.10. In a letter to the Secretary of State dated 12 December 1990 the Chairman of LRT briefly reviewed the progress for the year to date against its original EFL and requested a further grant for 1990/91 of £70 million. The letter indicated that this money was all required by LUL.

4.11. LRT's original EFL allocation to LUL was £308 million. This had subsequently been amended to £268 million. The difference of £40 million was LRT's allocation of the previous year's overrun to LUL. LRT set a target EFL for LUL at £250 million in October 1990, following the downturn in LRT's income and property disposal prospects. The additional requirement of £70 million by LUL was based on a forecast out-turn against the 1990/91 EFL for LUL of £320 million. This forecast had been prepared by LUL management in late November/December and was set against the agreed target EFL for LUL of £250 million.

4.12. Table 4.1 compares the target EFL for 1990/91 with that latest forecast out-turn for the year, prepared in period 12.

TABLE 4.1 **LUL out-turn against target EFL, 1990/91**

£ million

	Target EFL	*Latest forecast out-turn (period 12)*	
Income	589	576	
Cost of operations	(543)	(577)	
Operational surplus/(loss)	46	(1)	
Depreciation	(88)	(88)	
Renewals	(77)	(77)	
Loss before grant	(119)	(166)	
Grant in support of operations	120	120	
Profit/loss	1	(46)	
Capital expenditure	(243)	(311)	
Add back: depreciation	88	88	
	(154)	(269)	
Working capital movement	24	69	
Further cash requirement from LRT*	(130)	(200)	
Summary of cash requirements			
Grant in support of operations	120	120	
Further cash requirement from LRT	130	200	
	250†	320	(+70)
Summary of project expenditure			
Capital expenditure	243	311	
Renewals	77	77	
Revenue projects (included in cost of operations)	20	22	
	340	410	(+70)

Source: LUL.

*To be funded by property sales, cash loan movements and capital grant. The property sales are dealt with by LRT separately from LUL's EFL allocation.

†LRT told us that in the letter to the Secretary of State dated 12 December 1990, the Chairman was referring to the change in forecast grant required for 1990/91 from period 7 to period 8. LUL forecast at period 7 that £250 million grant would be needed and at period 8 that £320 million would be needed, a difference of £70 million. The increased grant is £52 million higher than budget. These figures exclude any grant required for Jubilee Line and East-West Crossrail.

Note: Period 7 ended 13 October 1990, period 8 ended 9 November 1990. LRT explained that the figures submitted to the House of Commons Select Committee were based on the LUL budget EFL, as requested by the Select Committee. The LUL budget EFL was £268 million and the overrun explained to the Committee was £52 million against the forecast out-turn of £320 million.

4.13. The net overrun for the year 1990/91 is therefore currently estimated at £70 million. This coincides with the £70 million requested in the letter of 12 December 1990, which included £15 million for contingencies. In response to that letter LRT has been advised by DTp that its EFL for 1990/91 will be increased by £55 million. The Government's intention, in increasing the EFL by £55 million, was that if required the £15 million for contingencies could be met by LRT's end-year flexibility whereby as a nationalised industry LRT may be allowed to exceed its EFL by up to 1 per cent of forecast turnover and fixed investment expenditure on condition that the amount of the excess would be deducted from the following year's EFL.[1] Decisions on the level of Government funding for 1991/92 still await the outcome of discussions between DTp and HMT, including the question of whether all or any of the £55 million will be deductible in 1991/92.

4.14. An analysis of the make-up of the £70 million overrun is given at Appendix 4.1. A comparison of the forecast out-turn for 1990/91 of £320 million against the actuals to the end of period 12 and the balance available in period 13, to achieve the latest forecast, is set out in Appendix 4.2.

[1]This facility is only available within the last three months of the financial year and is subject to the approval of the Secretary of State.

Incidence of recovery programmes and revised forecasts

4.15. In the first eight months of 1990/91 there were three recovery programmes and three revised forecasts. Table 4.2 sets out the various net cash requirements they produced as compared with LUL's original budgeted EFL. The variation between the lowest and the highest requirement is some 30 per cent. Subsequent forecasts, although differing in make-up, show a LUL EFL requirement very close to the period 8 forecast figure. The period 8 forecast figure allowed for a contingency identified as `a risk factor' of £15 million. This was intended to offset any optimism that may have been built into income or cost reduction figures.

TABLE 4.2 **Revised forecasts/recovery programmes for 1990/91 financial year produced in that year**

£ million

Original budgeted EFL	308 (further reduced to £268m in July)
June 1990 recovery plan	260
Period 6 forecast (September)	328
Period 6 recovery plan (September/October)	257
October 1990 forecast	284
October 1990 recovery plan	250
Period 8 forecast (November)	320

Source: LUL.

Note: The ring-fenced Jubilee Line extension is not included in the above figures.

Monitoring and control against the budget EFL

4.16. The interactive relationships of the elements making up the EFL have been outlined in paragraph 4.9. LUL has tended to compensate for overruns in project expenditure, temporarily at least, within each year, by movements in working capital, typically increases in creditors over and above the figure assumed in determining the net EFL. This has a cosmetic effect only, leaving the creditors in excess of those budgeted to be paid in the following year out of grants which were determined on the basis of the original budget figures for closing creditors. In so far as the creditors arise from variations in the phasing of spend for any particular project, the impact may not be significant on management's ability to live within the following year's EFL. The assumption is that the earlier spend was intended for the following year and therefore funds had been planned to meet that spend. However, the impact is significant where the excess creditors do not arise merely because of phasing variation. Table 4.3 compares actual and budgeted levels of creditors at 31 March in the years 1989 to 1991 (forecast).

TABLE 4.3 **Comparison of creditors, actual/budget, as at 31 March**

£ million

	1989	*1990*	*Forecast 1991*
Actual			
Capital	45.0	67.3	105.6
Other	62.2	84.4	100.1
	107.2	151.7	205.7
Budget			
Capital	40.6	49.0	65.9
Other	39.0	45.9	65.6
	79.6	94.9	131.5
Actual above budget	27.6	56.8	74.2

Source: LUL.

The actual level of capital creditors forecast for the end of 1990/91 of £105.6 million represents just under 26 per cent of the latest forecast project expenditure for the year.

4.17. The lack of effective control of expenditures in relation to the EFL has, however, been most obvious in the area of cash management, where in 1990/91 it led to a succession of cash crises.

The project expenditure slippage allowance

4.18. The project expenditure of £340 million in the LUL target EFL (see Table 4.1) comprised an expenditure budget of £401 million offset by a `credit slippage' of £61 million. The slippage allowance is 15 per cent of the project expenditure budget or 1.8 months' expenditure if such expenditure were even throughout the year. In preparing the phased project expenditure budget which is required both for cash control and project monitoring both elements of the budget are taken into account. The process of phasing is not, however, merely one of simply reducing all budgets by the necessary slippage percentage. Some projects will be totally displaced in time, while for others the expectation will be for the whole budget to be spent with no slippage. The dangers implied in this method of control are illustrated by the fact that the Project Managers' current forecasts are for an out-turn spend of £410 million and LUL has stated that it is felt unlikely that any significant slippage will now arise.

Flexibility in project expenditure phasing

4.19. The rules under which the grants are made available to LRT by DTp are rigid. LRT acts for LUL in drawing down the grant from time to time. To enable DTp to monitor the actual requirements for grant compared with budget LRT is required to provide an estimated corporate phased budget profile, showing the forecast cumulative expenditure and income for each four-weekly period during the year and identifying any unusual items. Any grant will not normally be paid in advance of need and consequently payments will not necessarily be made in accordance with the grant drawing profile. At least one week before LRT considers a payment is needed it must present a claim and provide appropriate supporting information to demonstrate that the amount of grant sought is indeed required.

4.20. Any cash requirement remaining after the amount of grant previously estimated has been paid will normally be covered by temporary borrowing, subject to approval by the Government, to be repaid the following year (deducted from the EFL for that year), by a reduction in the level of capital expenditure and/or improvements in internal resources such as cutting operating expenditure. No additional grant will be paid unless DTp and HMT agree that it is warranted by very exceptional circumstances.

4.21. The application of these rules implies that where project expenditure is under-running for whatever reason the relevant part of the grant is lost at the end of the year.

4.22. One of the major problems associated with control of projects has been that budgets are related to the value of work done whereas the EFL is related to cash payments.

Pro-active planning

4.23. The budget and business planning cycle for LUL starts in August of each year. LUL's Business Plan covers the forthcoming budget year and five subsequent years.

4.24. Planning guidelines are issued to the directors and business unit managers. It is their responsibility to prepare the budget and business plan for their own area. The guidelines incorporate passenger miles, revenue and cash take forecasts covering the six-year period, together with quality of service indicators and other basic assumptions to be used in the planning process.

4.25. The first draft plan is reviewed by the Board in late October/early November; at the same time the EFL for the coming financial year is announced together with the `guidelines' for the following two years. LRT is permitted to commit 100 per cent of the EFL and 85 and 70 per cent respectively of the guideline amounts for years two and three. Towards the end of November, after the announcement of the EFL, the changes to the budget and plans which are necessary to bring them into line with the EFL are given to the business units. The revised budget is submitted for approval by the Board in mid-December.

4.26. The budget and business plans are submitted to the LRT Board for final review in mid-February. In mid-March the plan is presented to DTp officials prior to an Investment and Financing Review (IFR)/Business Plan presentation to Ministers in mid-April. The plan may be subsequently amended.

4.27. When the updated five-year plan is approved by the LUL Board in May it forms the basis of the submission to LRT for incorporation into its submission to HMT of the revised IFR in July.

4.28. The cycle is annual and there is considerable variance between the consecutive annual plans for any particular year. The final budget, more often than not, bears little relationship either to the IFR submissions between years or the IFR figures for the budget year. Table 4.4 shows the variation in the 1990/91 LUL submissions made in the three years 1987, 1988 and 1989.

TABLE 4.4 **LUL submissions for the year 1990/91 made in 1987,1988 and 1989**

£ million

	Guideline years		*Budget year*
	1987	*1988*	*1989*
February submission to LRT	(35)	(266)	(383)
Initial bid, April	(67)	(220)	N/A
Revised bid, July (submitted June)	(21)	(278)	(366)
Final bid, August (submitted July)			(381)
LUL portion of DTp guide-lines for 1990/91	(3)	(222)	
LUL portion of DTp EFL for 1990/91 (before adjustments)			(308)

Source: LUL.

Note: ( ) = grant required.

4.29. The frequency of revised forecasts and recovery programmes in the budget year (see Table 4.2) confirms a general impression that the budget is used more to indicate the extent of the variance than to provide targets which must be met. This is reinforced by the evidence of actual out-turn against budget and the requests for supplementary grants.

4.30. LUL told us that the planning process was essentially a `bid' for allocations by each of the directors/business unit managers and the capital expenditure plan was a prioritised `wish list'. The budget was aligned to the EFL when it was announced and was therefore driven by the EFL.

4.31. In summary, the present planning process is characterised as an aggregation of `bids' for operating expenditure and a prioritised `wish list' for capital expenditure. These bids are adjusted to represent the needs of the business and, if necessary, further adjusted to the EFL as it is announced each year. Planning thus moves in yearly steps, resulting in a budget adjusted to the EFL.

The integrated budget and business plan

4.32. The budget and business plan are prepared at the same time within the same budget/planning cycle. The cycle starts in August and the budget finishes in March of the following year, with the business plan cycle effectively being completed with the presentation to the Secretary of State in April.

4.33. The budget essentially serves two main purposes:

(a) it sets out in detail the short-term action plan against which management must control operational and capital spend if they are to live within the EFL; and

(b) it provides DTp with a phased grant drawing profile and cash flow data against which it can monitor the performance of management in living within the EFL.

The budget, although it is begun some three months before the EFL, does not influence the EFL decision. Further the `first cut' budget may have to be amended from November onwards when the EFL is announced. The magnitude of the change required could be reduced, however, if the `wish list' were more closely related to the provisional EFL for the year in question (ie the `guidelines' laid down at the same time as the previous year's EFL).

4.34. The five-year business plan is used to provide DTp with information on which to determine the EFL for the next budget year (first year of the five-year plan) and the guidelines for the following two years (years two and three of the plan). There is little evidence that the five-year plan is used for long-term target setting by management, because there is little, if any, consistency in successive plans, as illustrated by Table 4.4.

4.35. The first stage of the IFR is in April of each year when LRT is required to provide DTp with its funding requirement bid for the following fiscal year together with the two subsequent years. The case for the first-year claim (eg 1991/92 in the bids submitted in April 1990) is made against the equivalent (second) year of the previous (1989) bid. This represents the `guideline' for 1991/92 announced at the time the EFL for 1990/91 was announced in November 1989. The bid compares this guideline with the first year of the current five-year plan (ie the latest plan begun in August of the previous year). Reasons for major variances are given. There is clearly a need for a strong thread of consistency to run between each five-year plan because one year's `guideline' becomes the next year's base EFL. If constant fluctuations/variations occur then the continuing stream of activities from year to year is interrupted, with the adverse effects which have occurred.

4.36. The effect of running the budget and business plan together is the tendency to confuse tactics with longer-term strategy and the tendency for management's attention to be overly concentrated on short-term issues.

LRT Cash Management Review

4.37. In November 1990 the newly appointed LRT Board Member for Finance asked a firm of consultants to make a brief review of cash management effectiveness in LRT. This initial overview was followed by a further review commissioned in February 1991 and completed in mid-March. The initial review pointed to a number of deficiencies. Amongst these was the conclusion that inadequacies in the project control and accounting systems in LUL had hidden overrun expenditures. It was also concluded that despite the failure of the accounting systems to provide clear-cut evidence of the cash crisis in numerical terms, existence of the crisis was known and management action to deal with the matter should have been taken more vigorously by those who were responsible. In the view of the consultants it was unlikely that steps could then be taken so late in the financial year to rectify the position for 1990/91.

4.38. In February 1991 the consultants were asked by LRT to review the proposed changes to the system and control procedures for cash management. These changes were mainly in LUL although some of them were being made at group level.

4.39. The review of the proposed changes was completed in mid-March 1991. The principal recommendations were directed at tighter controls on project expenditure. The recommendations included the creation of an investment committee to be responsible for ensuring that future cash would be available before any project was released, that the relevant director should present an explanation and recovery plan in cases of any cash overruns and that a new senior finance manager to be responsible for total business cash forecasting and cash limit control should be appointed.

4.40. The consultants were of the view that although their recommendations had been accepted by LUL in principle the implementation plan would not provide a complete cash control system by 1 April 1991 and they were unable to confirm that they expected LUL to be in a position of operating a total cash control system with detailed project control procedures by that date. Whilst the consultants' recommendations are inevitably more detailed the main thrust of the recommendations is similar to the conclusions arrived at in our inquiry.

The starting financial position for 1991/92

4.41. Despite the possible favourable impact of the recently proposed operating economies in a number of respects LUL's starting financial position for 1991/92 gives ground for concern. In the first place, LRT has taken a view that the group's EFL of £539 million is inadequate to meet the needs of the group and has, therefore, made formal representations to DTp and HMT for an increased EFL. Until their decision is known the allocation of the EFL to LUL will remain provisional. Secondly, as shown by Table 4.3 the forecast opening level of project expenditure creditors is £105.6 million, or some 26 per cent of the 1990/91 project expenditure budget. If this level of creditors is to be reduced by the end of 1991/92 then part of the 1991/92 EFL will be taken up with this reduction. The third uncertainty is the possible allocation to cover, either in part or in whole, the additional £55 million advanced in 1990/91. If DTp and HMT determine that the £55 million must be recovered from the 1991/92 EFL this will further impact on the 1991/92 grant. Moreover, the £15 million drawn in 1990/91 under the end-year flexibility arrangement (see paragraph 4.13) will also fall to be recovered from the 1991/92 EFL. If the excess creditors, the additional grant and the £15 million have arisen largely because of earlier than planned expenditure which had been budgeted in 1991/92 our concern would be lessened. However, LUL has informed us that this is not generally the case. We think it appropriate to draw attention to these problems although funding is a matter for the Government. DTp told us at the end of our inquiry that it did not anticipate that LRT's 1991/92 EFL will be reduced to offset the 1990/91 increase. (No decision has been reached on whether the EFL will be increased.)

Financial results

4.42. Table 4.5 shows LUL's audited financial results for its first five years' operations to 31 March 1990.

TABLE 4.5 **LUL's financial results, 1985/86 to 1989/90**

£ million

	1985/86	*1986/87*	*1987/88*	*1988/89*	*1989/90*
Income					
Traffic income	339.7	369.8	400.8	431.6	461.9
Other income	24.1	26.5	30.5	35.9	41.7
Total income	363.8	396.3	431.3	467.5	503.6
Operating expenditure					
Cost of operations	316.2	319.6	336.1	378.4	462.2
Depreciation	57.5	61.4	63.5	74.9	81.9
Renewals	62.9	82.5	67.9	79.3	71.8
Cost of ancillary activities	6.0	6.1	7.0	7.5	11.3
Total expenditure	442.6	469.6	474.5	540.1	627.2
(Loss) before grant	(78.8)	(73.3)	(43.2)	(72.6)	(123.6)
Grant received	109.0	86.0	50.9	53.6	102.9
Profit/(loss) after grant	30.2	12.7	7.7	(19.0)	(20.7)
Total investment expenditure	135.1	171.2	206.1	214.5	307.3
Less: depreciation and renewals	(120.4)	(143.9)	(131.4)	(154.2)	(153.7)
Net investment expenditure	14.7	27.3	74.7	60.3	153.6
Capital grants	(15.5)	14.6	57.1	36.7	141.6

Source: LUL.

Note: `Depreciation' represents, in accordance with conventional practice, a notional charge which is credited to a provision, whereas `renewals' represents an actual charge for renewals expenditure actually incurred.

4.43. Table 4.6 compares LUL's traffic income as shown in Table 4.5 with LUL's expenditures at the three different levels of:

- B, cost of operations before charging depreciation and renewals;

- C, total cost of operations, including depreciation and renewals; and

- D, total cost of operations plus net investment expenditure.

TABLE 4.6 **Calculation of business financing requirement, 1985/86 to 1989/90**

		1985/86	*1986/87*	*1987/88*	*1988/89*	*1989/90*
A. Traffic income	*£m*	339.7	369.8	400.8	431.6	461.9
B. Cost of operations before depreciation and renewals	*£m*	316.2	319.6	336.1	378.4	462.2
A as % of B	%	107.4	115.7	119.3	114.1	99.9
C. `PL expenditure' (B + depreciation and renewals)	*£m*	436.6	463.5	467.5	532.6	615.9
A as % of C	%	77.8	79.8	85.7	81.0	75.0
Balance requiring financing	%	22.2	20.2	14.3	19.0	25.0
D. `PL expenditure' plus net investment expenditure (ie total investment expenditure less depreciation and renewals)	*£m*	451.3	490.8	542.2	592.9	769.5
A as % of D	%	75.3	75.3	73.9	72.8	60.0
Balance requiring financing	%	24.7	24.7	26.1	27.2	40.0

Source: MMC.

4.44. It will be seen that, except in 1989/90 when it almost broke even, LUL's traffic income consistently produced an operating surplus before charging depreciation and renewals. The balance of expenditure not covered by traffic income represented the business financing requirement. In so far as this was not covered by other sources of finance (eg net property rentals and advertising revenue, asset disposal proceeds or working capital movements) it was equivalent to the extent of state subsidy (see Table 4.6).

4.45. At 31 March 1990 LUL had total capital employed of £4,282.4 million, made up as shown in Table 4.7.

TABLE 4.7 **Capital employed at 31 March 1990**

	£m
Current assets	108.4
Less: current liabilities	(166.5)
Net current liabilities	(58.1)
Tangible fixed assets	4,343.6
	4,285.5
Non-current liabilities	(3.1)
	4,282.4

Source: LUL.

Tangible fixed assets consist of renewable infrastructure, eg station finishes and permanent way, basically carried at the estimated cost of modern equivalent assets in 1985, or cost of subsequent additions, and replaceable assets, ie fixed assets other than infrastructure carried at net current replacement cost. Renewals of infrastructure are charged to profit and loss account as and when incurred and replaceable assets are depreciated.

Financial targets-measures of profitability and efficiency

4.46. Both LUL management and LRT believe that LUL's overall financial target should be the generation of sufficient cash income from traffic operations to cover not only the cost of operations before depreciation and renewals (which it more than achieved between 1985 and 1989-see paragraph 4.43) but also replacements and renewals, as distinct from enhancements and extensions which would continue to be funded externally.

4.47. Aside from that objective LUL agrees that it does not use any defined measures of profitability, in particular measures related to the products which it sells, ie passenger miles and passenger journeys.

4.48. LRT and LUL management regard an adequate cash flow as critical to LUL's success.

4.49. As agreed with DTp, LUL's standard of economic efficiency is based on cost, ie average profit and loss expenditure per train mile. Such costs are set out in Table 4.8.

TABLE 4.8 **Costs per train mile**

	£ per train mile	
	Excluding depreciation and renewals	*Including depreciation and renewals*
1985/86	10.6	14.7
1986/87	10.4	15.1
1987/88	10.6	14.7
1988/89	11.7	16.5
1989/90*	14.5	19.4

Source: LUL.

*Adversely affected by industrial action.

Allocation of costs

4.50. Until 31 March 1989 indirect costs (ie those not directly chargeable to a specific cost centre) were allocated or apportioned in accordance with generally accepted accounting/costing principles and practice, on the basis that all costs should be fully absorbed by those units or parts of the organisation to which they could be attributed (ie on a full cost absorption basis). For example, depreciation was allocated to business units where `ownership' of the relevant assets was identifiable; accommodation was charged for on a square-footage basis; and LRT corporate overheads (which had been apportioned to LUL on a per capita basis) were charged to business units on a similar per capita basis.

4.51. However, some categories of costs, notably depreciation in relation to non-attributable assets, and engineering maintenance, neither were, nor are, allocated or apportioned at all but were, and currently are, carried by the engineering units responsible for them.

4.52. As from 1 April 1989, LUL adopted a line contribution approach to its financial reporting and management accounts. From a costs point of view (as distinct from income) this means that the line businesses are now only charged with:

(a) direct costs; together with

(b) apportioned costs which can be directly identified with them and which are deemed to be controllable by the LGMs.

As from 1 April 1990 the range of such costs was extended consequent on technical improvements to LUL's accounting system.

4.53. The principal features of this approach are that:

(a) identifiable and controllable costs;

(b) cash takings from sale of tickets, adjusted to an accruals basis;

(c) other traffic income distributed on an algorithmic basis; and

(d) apportioned costs

are identified with the specific line businesses. Following the introduction of a new General Ledger and Chart of Accounts in January 1990 the range of costs, both directly attributed to lines and apportioned to them, was extended.

4.54. The results of the line contribution system have been reported by period since 1 April 1989, both for individual lines and globally for LUL as a whole. Summaries of the Line Contribution Statements for 1989/90 and for the first nine periods of 1990/91 for the Central and Metropolitan Lines are incorporated in their respective case studies (see Appendix 2.1). Table 4.9 aggregates all LUL Line Contribution Statements for 1989/90 and for the first nine periods of 1990/91. It also expresses these results in the following three performance ratios:

- LGMs' contributions as a percentage of total income;

- traffic income as a percentage of cost of operations; and

- operating ratio, ie cost of operations, as a percentage of traffic income.

TABLE 4.9 **Summary and analysis of Line Contribution Statements: LUL, all lines**

£ million

	1989/90		*1990/91 Periods 1-9*	
Traffic income		416.6		331.6
Other income		29.9		22.3
Total income		446.5		353.9
Cost of operations:				
Stations	85.2		92.4	
Train operating	79.3		84.3	
Fleet maintenance	58.9		46.9	
Line administration	7.3		6.0	
		(230.7)		(229.6)
LGMs' contributions		215.8		124.3
Adjustments for revenue and costs outside LGMs' control:				
Traffic income resulting from other parties' operations	47.9		41.3	
Allocated costs etc	(3.1)		(4.2)	
		44.8		37.1
Total net line contributions		260.6		161.4
LGMs' contributions as percentage of total income		48.3		35.1
Traffic income as percentage of cost of operations		180.6		144.4
Operating ratio, ie cost of operations as percentage of traffic income		55.4		69.2

Source: MMC from LUL data.

It will be seen that the three critical performance ratios were less favourable in 1990/91 than in 1989/90 and that this reflects a significant rise in the cost of operations. According to LUL this is due to the inclusion in the Line Contribution Statements of the following costs:

(a) traction current;

(b) electricity supply to stations;

(c) station cleaning;

(d) BR joint working agreements;

(e) information assistants' staff costs;

(f) uniform issues;

(g) staff taxis;

(h) safety and accommodation `Quick Fix' projects; and

(i) 1990/91 wage award (9.75 per cent).

4.55. The main areas of directly identifiable and attributable costs not as yet charged to the line businesses remain:

(a) engineering maintenance; and

(b) depreciation.

4.56. Costs directly attributable to line businesses and to other cost centres or groupings of cost centres are charged to them through the mechanism of the intra-business charging system.

4.57. LUL's Financial Controller and its Financial Planning and Control Manager are together responsible for deciding on the principles of cost allocation within LUL. These are then embodied by the Financial Planning and Control Manager in LUL's annual budgets. Actual costs incurred are then allocated or apportioned in accordance with these principles to produce actual figures corresponding to the budgeted ones.

Fixed asset creation and depletion

4.58. Basically LUL distinguishes between three distinct categories of fixed assets:

(a) non-renewable infrastructure, eg tunnels and embankments, carried in the balance sheet at nil value;

(b) renewable infrastructure, eg station finishes and permanent way. Such assets are not depreciated but work in connection with them which goes beyond mere maintenance is charged as renewals; and

(c) depreciable assets, ie fixed assets other than infrastructure.

4.59. Non-depreciable assets were revalued in 1985 on the basis of a sample valuation. Depreciable assets are revalued annually on a modern equivalent asset basis.

4.60. In 1989 the LUL Finance Director instituted a review of fixed asset controls and accounting policies. The principal results of this were: the initiation of a fixed asset census to identify, record, code and value all fixed assets-`Asset Census 1990'; and a review by external consultants of asset accounting policies and bases of valuation.

4.61. The consultants' recommendations were accepted in principle by the LUL Board but their development and the seeking of LRT/DTp approval was deferred pending the appointment of a new Finance Director, which ultimately took place in February 1991. In the meantime, existing policies and procedures are continuing to operate.

4.62. We have been assured that Asset Census 90 will go forward, although there are presently doubts within LUL as to whether the scope of its objectives should be limited to the engineering requirement for a detailed fixed asset inventory or should also extend to the accounting need for a detailed list of asset values and lives.

4.63. Depreciation rates vary widely and are based largely on asset lives whose validity is principally derived from engineering experience and tradition, unrelated to optimum replacement cycles.

4.64. LUL told us that it accepted the need for a full review of asset lives and depreciation rates which would take into account, *inter alia*, prospective technological development and optimum replacement cycles.

4.65. The statutory financial obligations to which LUL is indirectly subject impose on it the requirement of a depreciation charge. However, LUL has questioned the appropriateness of such a charge within the context of present funding and pricing policies in view of:

(a) the relative importance to it of cash flow as opposed to profit;

(b) the fact that fares levels are currently unrelated to profitability;

(c) the fact that investment funding is not dependent on depreciation provisions; and

(d) the fact that its infrastructure assets are not depreciated.

Financial systems

4.66. LUL has well-developed and sophisticated budgeting and day-to-day bookkeeping systems, built around its computerised General Ledger:Millenium (GL:M) data-processing family of systems. This is supported by computerised subsystems for payroll, purchase and stores recording. The systems are accessible by the accounting staff but there is no on-line enquiry facility available to other managers.

4.67. The operating revenue and expenditure accounting is hierarchical, built up from the smallest operating unit to the line businesses and the directorates. There are approximately 900 cost centres and 44 business units.

4.68. LUL told us that budgeting is carried out, from the bottom up, by budget centre managers but is co-ordinated by the Financial Planning and Control Manager, who provides most of the assumptions on which budgets are based.

4.69. As indicated above, the budgeting timetable begins in August each year, while the EFL settlement timetable runs from November. LUL told us that one of the results of this is that budgets may have to be revised to take account of subsequent EFL constraints.

4.70. There is a cash budgeting system independent of, but related to, the main budgetary control system. However, cash budgeting appears to have been directed towards cash forecasting and to lack effective commitment control. Also as indicated above, steps are now being taken to overhaul and strengthen cash control procedures and to relate them more closely to the wider financial context, notably by initiating a fortnightly rolling cash review.

4.71. LUL makes use of an intra-business charging system as between its various passenger service and engineering units. The purpose of this is to allocate costs directly attributable to units by means of internal invoicing. We note that there is no specific requirement for using such a system and LUL told us that it

considers that its use of intra-business charging may have become excessive and that this is subject to review.

Organisation of the finance function

4.72. The LUL finance function comprises two main elements:

(a) a central finance function forming part of the Finance Directorate; and

(b) accounting staff in individual business units.

These are summarised in Table 4.10.

4.73. Between 31 March 1986 and 8 December 1990 staff numbers in the finance function varied between 264 and 487. LUL told us that this increase occurred primarily as a result of transfers of responsibilities from LRT, eg for payroll and bullion services, which are currently provided by LUL for the whole LRT group.

4.74. LUL's accounting staff at 8 December 1990 totalled 487, as shown in Table 4.10.

TABLE 4.10 **Accounting staff at 8 December 1990**

Central finance function		
Financial Controller's Department		
Payroll staff	132	
Revenue Accountant's Dept	42	
Funds Manager's Dept	23	
Financial Accountant's Dept	38	
Others	52	
	287	
Financial Planning and Control	9	
Investment Controller's Dept	13	
LUL Internal Audit	36	
Finance Director/Company Secretary	4	
		349
Devolved accounting staff		
A. Working directly for the Finance/ Business Managers of the Engineering, PSG and PSD functions	56	
B. Working in subsidiary units	82	
		138
		487

Source: LUL.

4.75. Of the above departments, the Funds Manager's is concerned with the handling of cash takings, Financial Planning and Control with the budgeting process and Investment Control with the UIP and financial aspects of projects, notably project appraisal. Staffing is further considered in paragraph 7.58.

Audit matters

4.76. LUL is subject to the activities of four groups of auditors:

- DTp's grant auditors;
- LUL's external auditors;
- LRT's internal audit; and
- LUL's own Internal Audit.

4.77. LUL's external auditors perform normal statutory audit functions and issue interim and final management reports each year.

4.78. For each financial year between 1987 and 1990 the external auditors have drawn attention to problems in the areas of fixed assets, creditors, debtors and stocks in particular and to the continuing failure of LUL to deal with them adequately. LRT told us that this situation is now about to be remedied through the activities of its Audit Committee.

4.79. The LRT audit function originally carried out all internal audit work in LUL. It now retains responsibility for a limited number of activities, notably in relation to data processing, the financial appraisal of projects and value-for-money/efficiency audits; it also oversees the LUL internal auditors. Hitherto some 5 to 10 per cent of its work for LUL has been devoted to efficiency audits but proposals for increasing the volume of this type of work are now being considered.

4.80. The bulk of LUL's internal audit work is now undertaken by the LUL Internal Audit. In particular, it carries out a limited amount of work on behalf of the external auditors. Percentages of work categories undertaken in 1990/91 are as shown in Table 4.11.

TABLE 4.11 **Work undertaken by the LUL Internal Audit by type, 1990/91**

	%
Finance	10
Payroll	22
Revenue control	41
Maintenance	5
Stock/procurement	11
Capital expenditure	7
Data processing	4
	100

Source: LUL.

4.81. The strong emphasis placed by the LUL Internal Audit on revenue control (ie the control of cash receipts from ticket sales) reflects LUL management awareness that substantial leakages of cash might still occur on certain parts of the network as a result of customer fraud and/or peculation by staff.

4.82. To date the LUL Internal Audit has not undertaken efficiency or value-for-money audits. However, the activities of LUL's Resource Evaluation Group and value analysis teams cover this area and are described in paragraphs 7.38 to 7.46. As at 25 January 1991 the LUL Internal Audit had a total staff of 36, of whom 27 had no qualification above the level of Ordinary National Certificate.

Conclusions and recommendations

Financial planning

4.83. The planning process is essentially the reconciliation of `bids' for operating expenditure and capital expenditure `wish lists' with each year's EFL as it is announced. This leads to reactive rather than pro-active long-term planning. A pro-active approach would establish a plan in which each year slotted into the previous and subsequent years as a continuously integrated and consistent whole. The annual update would be a matter of fine tuning the first five years. The new final year of the plan would be properly integrated with those five years. The plan would be negotiated and agreed between LUL (or LRT) and DTp. A vital feature of the negotiations would be the agreement to the conditions and acceptance of the concomitant obligations with regard to grants, fares increases, escalation and other critical assumptions implied in the acceptance of the plan. We conclude that a reactive approach to planning is not appropriate to LUL and recommend that the plan should reflect a consistent and integrated route to the achievement of long-term objectives and should be agreed with DTp.

Flexibility in project expenditure phasing

4.84. The normal prudential business approach to funding capital expenditure is to establish flexible draw-down arrangements to cope with expenditure phasing variations from plan. The grant payment procedures do not allow for flexibility to meet such phasing variations. A particular problem arises from the consequences of underspending due to project programme delays. We conclude that a formal extension of the existing procedures to provide proper flexibility is necessary. We recommend a rearrangement of the existing procedures to permit flexibility to cover expenditure phasing variations; in particular, spend earlier than the original phasing could be met from the following year's EFL (where it should have been planned) where this is greater than the one percentage tolerance; greater use should be made of temporary borrowing powers; and delayed spend covered by advances placed on deposit with the National Loans Fund or elsewhere in the public sector for subsequent draw-down.

Monitoring and control against the EFL

4.85. The capital grant represents the net result of the capital expenditure budget and the movements in capital stores and in capital creditors. Monitoring and control is directed principally, if not almost exclusively, to the capital expenditure budget. Management responsibility is similarly diffuse in that the creditor level is regarded as the balancing factor rather than actively managed and controlled. We conclude that the existing procedures need amending. We recommend that responsibility for the monitoring of cash overspends and bringing these to the notice of the individuals responsible and for the management and control against the grant should be firmly placed on the company's Finance Director, who should nominate one specific individual to monitor and control all the elements comprising the EFL.

Project expenditure slippage allowance

4.86. The credit slippage allowance in the 1990/91 project expenditure budget was some 15 per cent of that budget. However, it is difficult to accept the need for a slippage allowance if the project expenditure budget is itself realistically assessed. Moreover the existence of a slippage allowance adds to the fuzziness in expenditure control figures. We understand that this is to be dropped and note that the project expenditure budget is to be drawn up realistically, based on achievable physical targets, to clarify the performance requirements.

Budget and five-year plan timing

4.87. The budget and five-year plan are produced in the same time cycle and to approximately the same degree of detail at LUL consolidation level. The two documents meet very different requirements and running these together confuses long-term strategy with short-term tactics. We conclude that, since the budget is driven by the EFL, a later start date might be appropriate and that, since the five-year plan is essentially geared to the DTp submissions, it would reflect a more up-to-date position if it were prepared in early January. We recommend that the budget preparation start date should be aligned with the EFL announcement and the five-year plan should be started at a date much closer to the IFR bid timing.

Cash control

4.88. Serious doubts have been expressed by LUL's senior management as to the quality and effectiveness of the company's controls over its cash receipts, in particular from traffic income.

4.89. At the same time, the succession of cash crises in 1990/91 resulting from the lack of effective controls over expenditures in relation to the EFL impelled LRT to commission a series of reviews of cash management by outside consultants.

4.90. We conclude from the above (see paragraphs 4.88 and 4.89) and from our own investigations that serious deficiencies still exist in the control of both cash receipts and payments and we recommend that LUL's new Finance Director should give the very highest priority to the imposition of effective cash controls and management to be in place by 30 June 1991.

Cash flow statements

4.91. It is important that LUL should produce periodical (four-weekly) cash flow statements showing estimated and actual figures for management purposes and for reporting to LRT and DTp. The content should be in line with the proposals (direct method) set out in the Accounting Standards Board Exposure Draft 54 issued in July 1990 or subsequent statements. Such cash flow statements are helpful in demonstrating the viability, liquidity and financial flexibility of an enterprise. We therefore recommend that monthly statements should be produced to show:

(a) the cash flow from operating activities;

(b) the cash flow from investing activities (basically capital expenditure);

(c) the cash flow from financing activities;

(d) the net decrease/increase in cash and cash equivalents;

(e) the cash and cash equivalents at the beginning of the period; and

(f) the cash and cash equivalents at the end of the period.

The figures should be in sufficient detail to show how the individual totals have been arrived at. Annual statements should also be produced and show the figures (estimated and actual) which formed the EFL for the year in question and be included in LUL's (and LRT's) published accounts.

Financial performance reporting

4.92. In view of the financial obligation imposed on LRT by section 15 of the LRT Act and indirectly on LUL as one of its subsidiaries, to `charge to revenue account … all charges which are proper to be made to revenue account, including, in particular, proper provision for the depreciation or renewal of assets', LUL's financial results have hitherto been expressed in conventional profit and loss terms. However, although LUL's operating surpluses before charging depreciation and renewals compare favourably with those of comparable international rail undertakings, LUL has at best only been able to cover 86 per cent of expenditures after charging depreciation and renewals. We conclude that, in the short term at least, the requirement to cover all costs taking one year with another is unrealistic.

4.93. LUL has not used measures of profitability related to passenger journeys and passenger miles. We believe that the absence of these is an undesirable omission from LUL's financial statistics and recommend that operating surpluses, before and after charging depreciation and renewals, should be expressed in relation to passenger miles and passenger journeys from 1 April 1991 onwards.

4.94. As a measure of efficiency, and for one of its financial targets, LUL has employed costs per train mile. We recommend that this measure should be supplemented, with effect from 1 April 1992, by a variety of measures related to other important operational characteristics such as numbers of employees and/or value of assets employed.

Depreciation and renewals

4.95. Depreciation rates vary widely and are based largely on asset lives whose validity is principally derived from engineering experience and tradition. We conclude that asset lives, and hence depreciation rates, should be more closely related to economically optimal replacement cycles, backed by rigorous financial/economic analysis, and should take greater account of prospective technological developments, in so far as these can be foreseen. We recommend that a full review of asset lives and the resulting depreciation rates should be undertaken in 1991/92, specifically taking these factors into account.

4.96. Although depreciation is charged in the accounts in accordance with normal accounting practice by making provisions for the amount of depreciation considered to be required, renewals of non-depreciable assets are only charged as incurred. We believe that this practice may understate the true cost of renewals and/or distort its incidence. We accordingly recommend that, with effect from 1 April 1991, the charge for renewals should be placed on a similar basis to that used for depreciation.

Budgeting, accounting and costing systems

4.97. We recommend that, in conjunction with a user-led review of MIS, a critical review should also be undertaken of LUL's budgeting, accounting and costing systems and the extent to which they should, or should not, be devolved to business units. This should take place in 1991/92.

4.98. Such a review should examine, *inter alia*, the possible use of, and scope for, flexible budgeting, eg for line activities, and standard costing for engineering workshops.

4.99. LUL has an intra-business charging system intended to ensure that costs are borne by those units which properly incur them. While sound in conception, this system appears to be unduly complex and to involve work and intra-business negotiation disproportionate to its objectives. We recommend that LUL should undertake an immediate review of this system with a view to its simplification.

Audit

4.100. During the last three years some important external audit recommendations have not been adequately implemented. We commend the further and strengthened emphasis placed by the LRT Audit Committee on the timely implementation of such audit recommendations, in particular by middle and junior management.

4.101. We note with approval that LRT and LUL are jointly taking steps to improve the quality of their internal audit functions. We also note that they are at present concentrating the activities of these functions on financial and accounting systems audits, in particular in the areas of cash and payroll, and that LUL is using separate value analysis teams to undertake efficiency and value-for-money reviews.

5 Management information systems

Introduction

5.1. In this chapter we consider the role and effectiveness of management information systems (MIS) within LUL. Under this heading we include IT strategy and the associated computer hardware and software. In 1989/90 revenue expenditure on IT amounted to £13 million and associated investment totalled £18 million. Responsibility for defining IT requirements and managing IT rests with the Head of IT.

5.2. The routine operation of the Underground makes significant use of control computers in such areas as the UTS and signalling systems. These applications are not the direct responsibility of the Head of IT and are not covered in this chapter.

IT strategy

5.3. It is acknowledged within LUL that IT strategy has been an area of weakness. Urgent steps have been taken to rectify this situation in the last two years. These have included developing many new and enhanced systems and a substantial increase in the level of investment in computer hardware and supporting communications networks.

5.4. There have been several radical changes of direction in LUL's computing and IT strategy in recent years. Until 1986 LRT Group Management Services provided a mainframe computing service and a software development service. In 1986 the mainframe computing service was privatised as Data Networks plc (Data Networks), a joint venture with Duport Computer Services Ltd. In 1987 the Business Services Department (software development) was sold to CAP Group plc (CAP). Subsequently both Data Networks and CAP were acquired by SEMA Group plc. Although LUL retained a Management Services Officer, computing and software development were treated in a piecemeal way and became an end-user responsibility. Major existing software systems were run on external bureau computers.

5.5. LUL carried out a review of its operational computing requirements in 1986 which led to the development of the TOMAS (Train Overhaul and Maintenance System) and SUTOR (Superbrain Timesheet Operating Railways-timesheet analysis) systems. Consultants were employed to develop a strategy for engineering systems, but in the event only a materials management system-the Railway Engineering Management System (REMS)-was implemented.

5.6. In 1986 a second firm of consultants was appointed to review LUL's overall IT strategy. It carried out this review during 1987 and found that there were unclear roles in the client/contractor method of working, no formal control framework, unco-ordinated implementation of systems, poor linkages between systems and an inefficient use of data processing resources. The consultants recommended the development of a Management Information Systems Strategy (MISS) in three phases. The first phase involved a general review of systems, management information (MI) needs and control arrangements. The consultants found that MI development was confused and out of step with the development of the organisation. They also reported that the information produced was widely regarded as being late, inaccurate, unclear, not pertinent and not usable. The consultants felt that a lack of definition of LUL objectives, business unit objectives, management roles and the LUL/LRT relationship contributed to these problems.

5.7. In July 1987 the consultants produced their report on Phase II of MISS. They established MI profiles for all business units and central departments, and considered that 42 systems were needed in 12 application areas. Thirty-eight of these systems were either new or needed major development work. The consultants recommended that LUL move to a computer hardware strategy based on three new minicomputers and an open-communications network over a five-year period. They also recommended that the number of workstations (including terminals and personal computers (PCs)) should be increased from 1,100 to 2,500 over this period. This strategy was costed at £44.8 million (1987 prices) over the five-year period. This total included capital costs of £27.8 million and total revenue costs of £17.0 million over five years. Benefits of between £9 million and £13 million per annum were expected. As the consultants considered that there were no resources to manage this strategy they recommended that LUL should:

- appoint a Head of IT;
- establish an IT Steering Group;
- increase systems staff to 77; and
- increase systems training.

5.8. In November 1987 LUL and the consultants produced the Phase III implementation report on MISS. This detailed Systems Development Plan included 45 systems, of which 17 were new bespoke systems, ten were new packages and 17 were enhancements of existing systems; one old system was retained. The following systems were identified as priorities:

- accounts receivable and cash management;
- contract management;
- timetabling and duty scheduling (upgrading);
- project management; and
- infrastructure and property asset management.

The overall cost of the strategy was then estimated to be £41.3 million (1987 prices) over a five-year period. This consisted of capital costs of £18.6 million and total revenue costs of £22.7 million over five years. The reduced cost was attributed to the proposed greater use of package software and to more efficient software development methods. Benefits were expected to total £27.8 million over the five-year period and £12.9 million per annum thereafter. The LUL Board accepted this plan for implementation in December 1987.

5.9. In November 1988 a Head of IT was appointed to manage the implementation of this strategy. He reviewed the strategy in the light of changing organisational requirements and produced an outline Information and Technology Strategy in March 1989. This strategy identified a problem of heavily restricted information flows caused by:

- paper-based systems;
- systems and subsystems which were not properly integrated;
- critical systems using out-of-date technology; and
- information not reaching the people who needed it most.

At this time LUL was undergoing a radical restructuring including the creation of the ten line businesses.

5.10. The resulting IT strategy approved by the LUL Board in March 1989 was designed to create an infrastructure which provided adequate computing capacity to meet planned needs and had the ability to transmit data from a corporate `pool' to all locations provided with IT services. It was intended to deliver professional standards of computing expertise and to provide systems which both met specific local business needs and contributed to the corporate information pool. To achieve this it was proposed that a structured hierarchy of linked systems using common standards should be created. On-line access to data would be made available for those who needed it. A vendor- independent computing environment based on the PICK and UNIX computer operating systems would be created, with the IT Department purchasing all hardware but leasing microcomputers to users at cost. Computing hardware would be supported by a high-capacity communications network, including fibre-optic links between major data centres. To increase compatibility and the efficiency of system development the maximum use would be made of common systems and off-the-shelf systems. To support this strategy the training of IT staff and users would also be

strengthened. LUL-wide initiatives begun included the Executive Information System (EIS) and the ARTEMIS-based TRACK project control system (see Chapter 12).

5.11. To establish an effective control system the IT Strategy Group (ITSG) was set up in November 1990. Its terms of reference include approving new software projects within the IT budget and ensuring that standards are met. The IT Strategic Plan is reviewed annually and an IT Manager liaises with each department.

5.12. To strengthen the standards of systems development a quality assurance function was established and a third firm of consultants was appointed to advise on implementing an IT Standards Framework. They produced a comprehensive and detailed report in April 1990. This covered the following areas:

- quality management;
- change and configuration management;
- the corporate data model;
- project management;
- system development and maintenance;
- computer operations;
- end-user computing; and
- tendering for subcontracting.

The consultants' report included detailed flow charts of the necessary activities in each of these areas.

5.13. Despite the progress made towards establishing a coherent LUL IT strategy and upgrading standards, the LRT Audit Committee reported to its Board in November 1990 that there continued to be a lack of a comprehensive, co-ordinated IT strategy throughout the group. It also reported that LUL's external auditors had expressed concern about inadequacies in the SUTOR system which prevented wages drift from being adequately identified. The auditors considered that the lack of a comprehensive IT strategy had aggravated this problem.

Computer hardware

5.14. LUL's strategy for computer hardware has three parts. External bureau computers are used for standard mainframe packages including the payroll, the GL:M general ledger package and the ARTEMIS-based TRACK project management system. A number of linked in-house minicomputer systems are used for company-wide MI systems and most of the applications needed to support the business. Following tenders, initial orders for minicomputers were placed with McDonnell Douglas Information Systems Ltd (MDIS) and these computers operated with a non-generic version of the PICK computer operating system. A post-installation audit report on the MDIS installation at Headquarters in November 1990 identified a number of problems:

(a) the system and the associated software were considered to be at high risk as there was no disaster recovery plan and the computer's basement site was unsuitable;

(b) these risks were increased by the lack of segregation of software development work from live applications;

(c) no back-up facilities were available; and

(d) operations documentation was unsatisfactory.

LUL has urgent proposals to rectify the position but these have not yet been fully implemented owing to financial constraints. A new stand-alone computer centre with additional capacity was planned, but has been deferred. Although a disaster recovery plan was implemented in February 1991, LUL acknowledges that there will be an element of risk to its systems for the next three years.

5.15. LUL placed a further contract for minicomputer equipment with Bull H N Information Systems Ltd in 1989 to reduce dependence on MDIS and move towards a more generic version of the PICK computer operating system. LUL now intends to move towards the more widely available UNIX operating system and in 1990 placed an order with Pyramid Technology Ltd for a UNIX-based minicomputer following competitive tendering.

5.16. Localised computing needs are satisfied using IBM-compatible PCs. Expenditure on PCs has increased from £0.5 million in 1987/88 to £5 million in 1989/90. The low initial figure is indicative of the poor level of local computing available to managers until recently. Following the increase in investment there are now some 2,500 PCs within LUL.

5.17. The increased level of computing in LUL has resulted in an explosion in demand for data communications. In addition to the rapidly increasing volumes of data transmitted, the number of sites to be served has increased from about 30 in 1988 to nearly 400. LUL has a large private telecommunications system, including 22 digital telephone exchanges connected by a fibre-optic trunk network, but the volume of data communications is such that the leasing of additional capacity from British Telecom plc has become necessary. Connections between users and the exchanges are in conventional cabling and are being adapted to provide a `data over voice' facility sufficient for the next three to four years' requirements. A more advanced communications network is being planned which will incorporate operations requirements in addition to MI requirements and provide for the next ten years' growth in data communications. This system will be based on the fibre distributed data interface (FDDI) standard for fibre-optic networks and may provide some scope for the commercial sale of spare capacity.

Computer software

5.18. As part of the changes in its IT strategy over the last four years, LUL has been steadily replacing or upgrading nearly all of its main computer systems. The earlier MIS developed and upgraded were designed to satisfy the needs of the immediate client without providing corporate information. These systems can be divided into three main blocks: financial systems, direct labour organisations monitoring systems and engineering systems. Although some degree of compatibility has existed between systems within each of these blocks, transfers of data between them are often manual. To overcome this problem new systems are now designed to be compatible with a corporate data model which will enable data to be accessed throughout the business.

5.19. The scale and urgency of the systems development tasks mapped out in the reports by the second firm of consultants in 1986 and 1987 (see paragraphs 5.6 to 5.8) did lead to some systems being hastily developed with inadequate documentation. Concern has been expressed within LUL that some systems, for example SUTOR, still do not meet the requirements of their users and need to be reviewed.

5.20. The Central and Bakerloo Line management teams considered that the central monitoring systems and databases did not give them adequate access to their line data and they have therefore developed their own PC-based systems. In addition the central information systems were considered not to be user driven and to be unresponsive. The audit report on the implementation of the GL:M general ledger system (February 1990) also identified the lack of user input during implementation as a problem, although the implementation was on the whole considered to have progressed smoothly.

5.21. The IT Department has responded to these criticisms by establishing the Management Information and Technology Steering Group to act as an IT `users' club'. New software development is intended to be more responsive to client needs and detailed contract specifications are agreed with the users before development commences.

5.22. LUL is now taking a longer-term view of software development and seeking to minimise the lifetime costs of systems rather than the initial development costs. The problem of inadequate documentation and differing standards has been addressed by adopting Learmonth and Burchett System Development Methodology (LSDM), a proprietary system development methodology based on Structured Systems Analysis and Design Methodology (SSADM), which should in future ensure that systems are developed in a controlled manner to meet user requirements. After one year of establishing formal software development standards, LUL now intends to seek standards accreditation for software development under

BS 5750. Off-the-shelf package solutions are being adopted where cost-effective and the LSDM approach facilitates the testing of potential system cost-effectiveness against known packages.

5.23. The MI software developed by the Central Line management is now regarded as a trial to be adopted by other lines if successful. Staff from the IT Department are working alongside the Central Line team to ensure that compatibility with corporate standards is achieved.

5.24. The case of the Computer Aided Railway Timetable (CART) system demonstrates that inadequate systems development discipline has in the past resulted in a lack of control over software projects. The extension of CART to cover all the lines in the system was originally expected to cost £59,000 in 1978. When development and extension to cover all lines was completed in 1988 the cost had reached £324,000 (Post Implementation Review, November 1990). The annual maintenance costs (£350,000 per annum) were also much higher than expected. CART is, however, considered to have proved its worth and is now essential to the running of the LUL system. The more disciplined and systematic approach now adopted should also lead to improved control over software development projects.

MI reports

5.25. Managers at all levels in LUL told us that they were dissatisfied with the quality of the available MI and this is recognised by senior management to be an area for priority action. Large volumes of MI reports are produced: two reports are produced daily; two reports are produced weekly; seven reports are produced four-weekly; and six reports are produced quarterly, in addition to the annual report for senior management alone. A variety of reports are also produced for middle management. The emphasis throughout tends to be on the provision of statistical/quantitative, rather than financial, information, with relatively little emphasis on profitability or cash flow.

5.26. A four-weekly Managing Director's Report is provided to LRT and DTp. At LUL Board level the four-weekly LUL Business Report is the main monitoring report and appears 12 working days after the end of the period. At Managing Director level the four-weekly Business Report is supplemented by the Finance Director's Commentary and the Business Reports from the line businesses. In addition daily reports are received on the peak train service. The weekly Executive Committee meeting considers detailed reports, including a weekly Traffic Receipts Report and a Safety Report.

5.27. Each directorate produces a four-weekly report for its executive director as well as detailed reports for each individual unit within the directorate. For example, in the Passenger Services Directorate each four weeks a Directorate Contribution Statement and a Directorate Management Information Brochure are produced. These reports are additional to the individual line business reports. Daily and weekly reports are produced on critical areas of performance, including trains in peak service.

5.28. Appendix 5.1 shows a matrix of the regular MI reports and their distribution. This matrix does not include the four-weekly Performance Statistics brochure which is made available to local authorities, the London Regional Passengers' Committee (LRPC) and other interested bodies, or any reports prepared for managers below LGM or Head of Department level.

5.29. We have examined the four-weekly reports which form a major part of the monitoring and control system. The main four-weekly report is the LUL Business Report, which contains a detailed analysis of operational performance indicators, staffing numbers, financial performance and customer survey results. Although it is a well produced document, making good use of graphic presentation and explanatory comments, it is somewhat lengthy (at 43 pages) for general distribution, bearing in mind that each directorate and line also produces its own four-weekly report. The report also contains a considerable volume of numerical data reproduced in their totality without making use of exception reporting or other methods designed to highlight significant items of information.

5.30. Each line produces a four-weekly business report and these are of varied formats which are entirely different from the LUL Business Report. We have taken as examples our two case study lines, which have a better than average standard of reporting. The Metropolitan Line Business Report includes well presented graphics and short explanatory commentaries to give an immediate impression of trends in performance. At 30 pages it is short enough to ensure that the line management team read and make effective use of it and, because the numerical data are kept to a minimum, the information is easy to absorb. The Metropolitan Line supplements its Business Report with a lengthy two-volume MI report containing detailed financial data, an overtime reporting summary and project expenditure reports.

5.31. The Central Line Business Report is again reasonably well presented, but is much longer (77 pages) and contains more numerical data. The relevant information is, therefore, less readily absorbed. Each of the other lines has its own style of business report with little consistency in content, style or standard of presentation.

5.32. Four-weekly Performance Reports are also prepared for functional departments and groups within functional departments. These reports sometimes cover very small numbers of staff: for example, the Engineering Director's Performance Report covered only two staff in period 7 of 1990/91.

5.33. The overall impression of LUL's MI reports is of variable quality, a wide variety of types of presentation and enormous volumes of paper. Several managers interviewed commented on the large quantity of paper received but have not put forward specific proposals to reduce it. The top management of LUL have also expressed their dissatisfaction with the MI available to them.

On-line MI

5.34. Access to on-line MI is available centrally to directors and some senior managers through EIS. This information is at an aggregated level only. At present the capability of EIS is severely restricted by the quality of the underlying database. This does not interface directly with the three sets of incompatible data corresponding to the three main groups of MIS software applications. LUL intends to upgrade the underlying database through establishing an integrated corporate data model, but this process will take about three years to complete.

5.35. The Central Line management team has developed its PC-based MI system (see paragraphs 5.20 and 5.23) to provide on-line information to all Central Line managers via networked PCs. This system is now regarded as a pilot project for the whole Underground.

Conclusions and recommendations

IT strategy

5.36. LUL acknowledges that it failed to establish a clear IT strategy for the first three years after its formation and that there were serious defects in its systems. Since then it has been striving to remedy this and to put a strategy in place. Following a number of changes in direction, a new Head of IT was appointed in November 1988 and an outline strategy was agreed in March 1989. Given the need to move rapidly to upgrade LUL's systems, some problems have inevitably emerged and are acknowledged by LUL. In particular, the LRT Audit Committee has recently expressed its concern about the continuing lack of a co-ordinated group IT strategy, and the external auditors have highlighted defects in the SUTOR system. We conclude that a period of stability is required to enable the agreed IT strategy to be fully implemented and any remaining problems in systems to be rectified.

5.37. Following detailed investigation by consultants LUL has selected a computer hardware strategy based on a mix of using external bureau mainframe computers for standard packages, using internal minicomputers for other company-wide systems, and using PCs for local computing needs. There has, however, been a lack of consistency in the sourcing policy for the minicomputers and the internal auditors

have expressed concern that some of the computer hardware and the associated software will be at risk until LUL is able to implement measures which have been identified to protect them. We conclude that the overall computer hardware strategy appears to be appropriate.

5.38. The rapid upgrading of LUL's computer software systems has resulted in some systems which do not fully meet the needs of their users. Since LUL's management structure evolved rapidly while the software was being developed, this particularly applies to the expanding needs of the line businesses. This problem will increase as further responsibility is devolved to the line businesses. LUL has recently taken steps to ensure that future systems are developed in a more structured and controlled manner and established the ITSG in November 1990 to strengthen the user voice in IT decisions. We conclude that the role of the users, and particularly the line businesses, needs to be strengthened further in controlling the IT strategy and software development. We therefore recommend that the ITSG should be strengthened, and that this enhanced role should include user sub-groups covering particular functional or business areas, eg line businesses or depots. These user groups would have the remit of setting software specifications and user acceptance testing.

MI reports

5.39. There is widespread dissatisfaction within LUL about the quality of its MI and internal management reports. Top management have acknowledged that this is an area for priority action. Numerous written reports are produced, many of which contain large amounts of indigestible numerical data. There is an uneven standard of presentation and little consistency of style across reports of similar types. This is notably the case with the line business reports. We conclude that both the number and volume of reports produced are excessive and that they are insufficiently action-orientated and focused on the key areas of management performance. We therefore recommend that an urgent review of MI reports should be carried out with the objectives of:

(a) reducing the volume and number of reports;

(b) focusing on a better digested and action-orientated presentation of the key items of performance data;

(c) ensuring that information is produced within a time-scale which enables corrective action to be taken effectively;

(d) improving and standardising the presentation of information by making better use of graphical presentation and exception reporting;

(e) spreading the best practice in report presentation amongst the business units; and

(f) ensuring that detailed numerical data are distributed only where needed.

We also recommend that LUL should ensure that the users of the reports are closely involved in reviewing their content and that this review should be completed by October 1991.

5.40. LUL's MIS are strongly orientated towards providing quantitative and statistical, rather than financial, information. Even in the LUL Business Report there are 21 types of non-financial reports, as against 15 finance-related reports, and the Quarterly Performance Summaries which the Business Report contains do not include any measure of financial performance. We conclude that LUL's MI reports are insufficiently directed towards the provision of financial information and, in particular, financial measures and efficiency ratios. We therefore recommend that the above review should specifically take account of the need for these.

5.41. Access to the limited amount of on-line MI in EIS is at present restricted to directors and some senior managers. This information is therefore effectively available on the basis of status rather than `need to know'. The broad-brush information largely duplicates what has already been distributed in the form of written reports. We conclude that the on-line MI should be more widely available on a need-to-know basis and should be made more comprehensive in its coverage. We therefore recommend that LUL should

extend the capability of EIS as rapidly as the underlying databases permit and make it available to managers at all levels as needed. We also recommend that in doing this LUL should examine the experience of the Central Line with its on-line database to determine the most cost-effective way forward.

6 Industrial relations, pay and employment policies

Industrial relations

6.1. LUL currently recognises nine trade unions for collective bargaining purposes. Together they represent about 84 per cent of all LUL staff. Membership figures are detailed in Table 6.1.

TABLE 6.1 **Trade union membership at 6 September 1990**

RMT (NUR)	*TSSA*	*ASLEF*	*EETPU*	*AEU*	*TGWU*	*BTOG*	*MSF*	*UCATT*	*Total members*	*Total numbers as % of LUL staff employed*
11,400	3,478	2,315	578	396	348	126	73	40	18,990*	84

Source: LUL.

*Includes members of some other unions.

Note: As these figures are mainly derived from LUL check-off arrangements actual union membership is likely to be higher.

An analysis of union membership by main function is shown at Appendix 6.1.

6.2. The bargaining and consultation machinery involving these unions and LUL management is currently in a state of flux. Traditionally in LUL the conduct of industrial relations has been governed through various `Machineries of Consultation and Negotiation' covering different groups of staff. The four principal committees are:

(a) the Railway Negotiating Committee (RNC);

(b) the Joint Negotiating Committee for Railway Workshop Wages Staff (JNCRWWS);

(c) the Joint Negotiating Committee for Railway Workshop Supervising Staff (JNCRWSS); and

(d) the Joint Committee of Unions for Cleaning Services (JCU for CS).

6.3. The RNC machinery, which includes nine Sectional Councils for different grades of staff (see Appendix 6.2), was established in 1957 by LRT and remained appropriate until LUL was formed as a subsidiary company following the LRT Act. As a result LRT-wide negotiations became obsolete, particularly under Sectional Council No 1 which dealt with all clerical and technical staff (other Sectional Councils deal with railway staff). The creation of client and contractor organisations within LUL Engineering which made Sectional Councils 5 and 9 inappropriate gave further impetus for change. It was, therefore, thought appropriate that a revision and updating of the machinery should take place including the other committees at *(b)*, *(c)* and *(d)* above in parallel with the RNC. In April 1985 notice of termination was given by management to the unions to expire in April 1986. The notice period was intended to allow for the negotiation of replacement machinery. New machinery was not concluded by that date and it was accepted by management and unions that ad hoc arrangements based on the 1957 agreement would continue as an interim measure. These arrangements have continued to date as efforts to reach a conclusion on new machinery have so far proved unsuccessful.

6.4. The changes proposed by management involve the breaking up of the network-wide Sectional Councils to enable the discussion and settlement of issues to take place at local business level. Terms and conditions of employment, including rates of pay, would be decided by joint negotiating councils for administrative, rail and engineering operations staff. The proposed new machinery is detailed at Appendices 6.3*(a)* and *(b)*. However, LUL's objective of settling relevant issues at as low and local a level as possible is directly opposed to the view of National Union of Rail, Maritime and Transport Workers (RMT) which is that Sectional Councils should continue to exercise a network-wide control over all staff matters including rostering, staff movements and promotions. As a result, negotiations have now been going on for nearly six years, since October 1989, through the medium of a joint working party (JWP), but agreement has still not been reached. At a recent meeting the unions emphasised that there could be no agreement while proposals to fragment Sectional Councils remained a management requirement.

6.5. There is no doubt that management has made sweeping changes over the past few years while the bargaining machinery has been in abeyance, albeit at the cost of some industrial disputes, and there is a view among managers that the present impasse is as much a deliberate management ploy as the result of union intransigence.

6.6. Besides the JWP examining new machineries for negotiation there are also JWPs set up to look at health and safety, train staff pay and conditions, station staffing and other aspects of LUL operations. Currently most JWP meetings are at a standstill due to union opposition to job losses recently announced by LUL (see paragraphs 7.8 to 7.10).

6.7. A London Underground Consultative Council (LUCC) was established in 1986 and meets at least twice yearly under the chairmanship of the Managing Director. All trade unions with which LUL negotiates are represented. Terms of reference include discussion on the economic climate as it affects LUL, the examination of future plans and the review of current performance, communications and the quality of working life. LUCC has established two sub-committees-one concerned with safety, the other with competitive tendering.

6.8. The industrial relations climate as measured by days lost to industrial action (see Appendix 6.4) has in recent years been good although disputes over the introduction of OPO on certain lines and the 1989 one-day strikes over train crew pay were particularly damaging. The latter dispute was eventually settled by an Advisory, Conciliation, and Arbitration Service (ACAS) Board of Mediation which found in favour of the unions.

6.9. Many managers, however, spoke of problems. The unions were said to act independently of each other and management often obtains agreement with one union on a particular issue only to have it vetoed by another union. Joint attendance at meetings by the three main unions (RMT, Associated Society of Locomotive Engineers and Firemen (ASLEF) and Transport Salaried Staffs' Association (TSSA)) is allegedly difficult to arrange and this is seen by some managers as a ploy to hinder unanimity of agreement. RMT is seen to be too centralised-all decisions must be referred to its Executive Committee-and opposed to change involving productivity or new procedures which might lessen its influence. Managers perceive it as having a closed perception of industrial life restricted to the railways with no outside experience or comparators. In contrast, ASLEF and TSSA are thought to be reasonably co-operative and open-minded. As an example, ASLEF has apparently indicated agreement to the direct recruitment of train operators (OPO will eventually result in a nil requirement for guards from whom train operators are traditionally promoted) whereas RMT has not.

Pay system

6.10. The pay structure in LUL can be conveniently divided into four main areas:

(a) Management, technical and administrative staff

The management salary structure provides 15 grades with overlapping salary bands based on a job-evaluated scheme. Performance-related pay for these grades, which is paid in addition to the annual inflation award, allows salary progression to take place subject to individual performance against agreed objectives and performance standards which should, as far as possible, be measurable.

While the average value of performance awards has stayed relatively constant in recent years the number of such awards has increased markedly, reflecting the increased number of managers within scope of the performance-related pay system-see Table 6.2.

TABLE 6.2 **Distribution of performance-related pay awards**

	1987	*1988*	*1989*	*1990*
Average value of award *(%)*	3.0	4.2	4.7	4.1
Number awarded	525	707	1,202	2,002

Source: LUL.

The recent introduction of performance contracts for top managers has further enabled attention to be focused on key outputs and objectives and their achievement or otherwise. New structures were introduced for technical and administrative staff in July 1989 based on a points-rated job-evaluation scheme. Both structures reduced the number of grades and widened salary scope. The higher grade in each structure has movement within its salary band based on individual performance against objectives. While the lower grade still retains incremental scales, upwards movement now depends on a positive recommendation, again based on performance.

(b) Control grade staff

Salaries in this small and declining group of staff are still incrementally based but the structure and role of this group is currently under review as part of LUL's continuing overhaul of grade structures.

(c) Supervising staff

Supervisors have a relatively complex salary structure attributable to its origins in the mid-1970s. Amendments have been necessary over time, mainly to adjust salary levels in response to changes in pay levels among those supervised. In addition to basic rates of pay over five grades for both railway and workshop supervisory staff a number of additional payments can be made. These include London Weighting allowance which is paid to all supervisors, a Work Study allowance which is paid to certain engineering supervisory grades, an OPO allowance which is paid to operating supervisors and various allowances and payments in return for productivity improvements.

(d) Wages grades

These staff can be broadly grouped into:

(i) operational staff in the Passenger Services Directorate (PSD)-train and station staff;

(ii) engineering staff in depots within PSD; and

(iii) engineering staff in Engineering Operations Directorate.

The main difference between the operational staff and engineering staff structures is that engineering staff have, in the main, incentive bonus arrangements. Many of these date from the mid-1970s, when a number of local productivity initiatives were put in place to respond to the competitive pressures of the external market and as a means of increasing wages during a period of Government-imposed pay restraint. As an example, depot maintenance labour is controlled by a measured work (standard hours) incentive scheme. Work values for manual operations are very slack and no verifications are carried out. Wages grade staff are only expected to complete the work content of the planned standard hours, regardless of actual time taken to complete tasks, and remaining time is unutilised. Bonus payments do not reflect performance. Administration of the bonus scheme is time-consuming.

6.11. Resulting bonuses amount generally to between 25 and 33 per cent of basic rates of pay and are frequently complex to calculate, as the following example of the calculation required for the workshops incentive bonus scheme shows:

> `The Incentive Bonus Office will use the data received on work record sheets, programme lift sheets, casualty lift sheets, shed-day sheets, modification work sheets and time allocation sheets to calculate performance according to the following formula:
>
> $$\text{OVERALL PERFORMANCE } P = \frac{S+EW+(0.90U)+(0.85W1)+(0.75W2)+PSH+HWA+DA \times 100}{A - M}$$
>
> Where:
>
P	=	Overall performance of group
S	=	Standard hours produced on measured work
EW	=	Emergency work credits
U	=	Approved actual attendance hours spent on unmeasured work
W1	=	Approved actual attendance hours spent on waiting work
W2	=	Approved actual attendance hours spent on waiting work because of industrial dispute in another section
PSH	=	Production Service Hours
HWA	=	Hot weather allowance
DA	=	Daily allowance
A	=	Attendance hours
M	=	Approved attendance hours booked for miscellaneous work'

Most of the elements in this equation are themselves subject to complicated calculation.

6.12. Workshop wages staff engaged in lift and escalator maintenance and renewal have a different wage structure. Local discussions to improve productivity during 1988 resulted in the introduction of an Annual Hours Contract-an all-in rate of pay in return for a commitment to a fixed number of worked hours and agreement to significant changes in working practice. The contracted annual hours also incorporate in some instances an amount of overtime which can be called on for emergencies and other unforeseen circumstances. The all-in rate of pay is expressed as an annual salary and includes all pay elements such as London Weighting, other allowances, unsocial hours payments and contracted overtime payments.

6.13. All LUL salaried staff are paid by way of 13 four-weekly periods in a year. In this and the complexity of the pay system LUL practice closely resembles that of BR.

6.14. We were told that much has been done in recent years to overhaul and simplify the system and future plans include a review of wages grade pay and structures based on up-to-date job descriptions. More attention will also be given to pay research to keep abreast of market conditions and competitors' rates of pay, particularly in respect of managerial jobs and skilled trades such as fitters.

Recruitment

6.15. Recruitment in LUL is organised and carried out by departments of the central Personnel Directorate.

6.16. The majority of staff, including blue-collar staff in PSD, are recruited by the Employment Manager's Department following requisitions from line and business unit managers. Sources of recruitment include job centres, open days at stations, job fairs, newspaper advertising and unsolicited applications. An agency is usually engaged to advise on and place advertisements. Most job seekers complete application forms and initial sifting is usually, but not always, undertaken with the appropriate line manager. Selected applicants are then invited to attend for a day spent on various tests covering basic numerical ability and verbal and mechanical reasoning plus a medical examination, following which job offers may be made, subject to references.

6.17. Some of the tests have been criticised by the Commission for Racial Equality (CRE), which published a report in 1990 concerning the selection arrangements for staff in the new PSD organisation. CRE found that LUL's centurion manager selection process had an indirectly discriminatory impact on some ethnic minority applicants, a conclusion which LUL has accepted. Following the CRE criticism,

undertakings were given by LUL to ensure that any appointment process followed complies with the Race Relations Act Code of Practice and is considered by the LUL Equality Board.

6.18. During the year 1989/90 the scale of recruitment was unprecedented, with over 3,000 staff recruited for PSD at an average cost of £325 per recruit. The urgent need for extra staff to be employed checking fire risks at stations as a result of the new section 12 requirements was satisfied by the recruitment of 350 staff in four weeks during January 1990. In addition 670 staff were recruited during the year to fill administrative and technical positions. Performance indicators are now being developed to improve the time-scales in the recruitment procedure, for example the number of days a vacancy is outstanding.

6.19. Many PSD line managers would like to be able to recruit their own staff and see this as a logical extension of devolution of personnel responsibilities. They claim that they could do this more quickly and more cheaply than the central Personnel Directorate and that, by recruiting locally for particular stations, they could ensure that staff were appointed to stations in their own home area. This would, they claim, vastly reduce the large number of internal staff movements across lines and between stations which takes place each year. Line managers would also be totally involved in the selection process and be responsible for, and have `ownership' of, their own staff. There would still be a need for a small central recruitment unit for advice and guidance but jobs saved centrally could be devolved to the lines.

6.20. However, the central view on devolved recruitment is that if every line recruited its own staff, job seekers would be confused with many contact points to choose from, standards of recruitment would vary and ultimately suffer and line bureaucracies would proliferate.

6.21. Management recruitment is conducted through the department of the central Personnel Directorate headed by the Personnel Services Manager. Requisitions from departments are first checked with the Organisation Development Manager to ensure that the need for the post is real, then to ascertain that the job has been evaluated, before advertising. After sifting based on a criteria short list, selected applicants are subjected to psychometric and personality tests plus a medical examination.

6.22. In 1989/90 604 candidates were appointed in respect of a total of 720 managerial posts advertised, from 10,598 applications received. The average cost per external candidate recruited was £2,771, while that per internal candidate was £542.

6.23. The recruitment of school leavers and graduates is undertaken by the central department headed by the Management Development Manager. Various LUL training schemes are open to school leavers, preferably with GCE A level or Higher National Diploma qualifications, including engineering, management and engineering technician training schemes. Contacts through the Careers Advisory Service and schools in the London area are the main sources of recruits-38 in 1989/90, at a cost of £2,400 each.

6.24. Graduates are recruited following national press advertising and attendance by LUL representatives at the annual `milk round' of universities. Final selection is the result of assessment at the management training centre at Flagstaff House. Twenty-nine were recruited from 1,000 applications in 1989/90, at a cost of £3,500 each.

6.25. Apprentices for a variety of trades are recruited directly by the Engineering Training Centre (ETC) in Acton to work eventually at EOW and line depot workshops.

Training

6.26. LUL told us that it has a corporate training policy aimed at developing a highly skilled workforce motivated towards achievement of optimum performances and output. Responsibilities are clearly defined in the policy document, as are the training standards to be achieved, which particularly emphasise the need for safety, induction and regular refresher training, training for promotion, training in the use of new technology and the needs of new and temporary staff. As a result a wide range of training is carried out in LUL as summarised below.

6.27. Induction training is received by all new staff. Since January 1991 this has comprised a half-day `welcome programme' for all staff regardless of grade, held at the London Transport Museum in Covent Garden. The programme emphasises LUL's mission, objectives and relationship with customers as well as providing background information. After attending the programme new staff are given further induction training at their workplace by their line managers.

6.28. Vocational training for blue-collar staff covers skills and safety training and is provided at various training centres mainly, but not exclusively, belonging to LUL. ETC is devoted to apprentice training and adult skills training, each occupying about 50 per cent of its resources. Currently there are some 54 apprentices on roll (39 from LUL) and, as over the years apprentice training has declined, so ETC has undertaken adult training for outside companies and organisations. Trades covered include electrical/electronics, mechanical fitting, sheet metal work, welding and vehicle building but adult courses can be designed for client needs. There is spare capacity at ETC, which is open Monday to Friday, 8 am to 4 pm, and attempts have been made to interest more outside organisations, particularly as ETC charges at cost. However, no prospectus was available at the time of our inquiry.

6.29. The Railway Training Centre (RTC) at White City offers vocational, promotional and refresher training for station, train and some fleet staff, with some 80 separate courses lasting from one day to three months. There are nearly 80 instructors and RTC is open seven days a week, as some courses need to be run at weekends to cater for staff availability. Course pass rates are in the region of 70 to 80 per cent, with the notable exception of the course for guards on promotion to train operators, where the pass rate is less than 50 per cent. The reason for this is that guards with six months' seniority are entitled to attend the course regardless of ability or motivation.

6.30. The efficient scheduling of training presents problems, as estimates of future training needs provided by the lines through central manpower planning are not reliable and frequent changes are made. Besides ETC and RTC training a great deal of training is carried out locally by various business units, notably the lines and the Engineering Operations Directorate. The latter runs courses for staff employed in permanent way and workshops, lifts and escalators, signals and electrical engineering; the distribution business unit; mechanical engineering workshops; and cleaning services.

6.31. A new vocational training centre is planned at a cost of some £29 million on the site of the existing ETC at Acton. This centre would replace RTC, ETC and various other training centres in engineering operations and offer substantial benefits from centralised training in a new purpose-built centre. However, its planned completion in 1993 is now uncertain due to financial restrictions.

6.32. Management training is organised corporately within the central Personnel Directorate. A wide range of off-the-job courses is offered on an individual needs basis and use is made of outside management training organisations, including those offering outdoor/orienteering-type courses. Flagstaff House near Weybridge, Surrey, is also used for management training purposes and is run as an hotel and separate cost centre with no trainers on its staff. It is free to cater for outside organisations as well as LUL, which it does on approximately a 50:50 basis, charging the same competitive prices to both. Problems include large LUL block bookings often with last-minute cancellations which could have been filled by outside organisations, and orders to run `at cost' pre-retirement courses. The weekday residential usage rate for 1989/90 was 85 per cent, the weekday non-residential usage rate 65 per cent and the weekend residential usage rate 35 per cent.

6.33. We were told that LUL is increasingly offering its staff the opportunity to participate in self-development training by distance learning or by a mixture of distance learning and tutorials. A Certificate in Management Studies course is offered to junior and middle managers, involving attendance for one day a week throughout one academic year. The course is run in conjunction with Havering College and held on LUL premises in Central London. Currently there are two streams of 18 places each. A National Examining Board for Supervisory Management Certificate course is available to supervisors and first line managers, similarly held in Central London and run in conjunction with Havering and Harrow Colleges. Four streams of 18 places each are available.

6.34. LUL told us that it also manages a wide range of training schemes including:

(a) engineering apprenticeships in most trades;

(b) graduate training in engineering, finance, personnel and procurement;

(c) youth training for entrants under 18;

(d) junior management training programmes; and

(e) executive development programmes.

6.35. In recent years the range and volume of training in LUL has been affected by:

(a) the reorientation of LUL's culture in a more business-like and commercial direction, using quality management techniques;

(b) the King's Cross fire; and

(c) the major reorganisation in 1988.

6.36. As a result, in 1989/90 the number of training and associated administrative staff rose from 171 to 193, to cope with the heavy demand for services including training which at ETC alone increased by 31 per cent. Anticipated spending for 1990/91 is much higher than in 1989/90, as shown in Table 6.3.

TABLE 6.3 **Training days and costs**

	1989/90		*1990/91*	
	Training days '000	*Spend £m*	*Training days '000*	*Spend £m*
Management training (including self-development)	11.8	1.8	18.0	2.7
Corporate vocational training	132.7	2.9	172.0	5.0

Source: LUL.

For 1989/90 the average number of training days per member of staff approximated to seven. For 1990/91 this is planned to increase to nine.

Absenteeism and labour turnover

6.37. LUL's 1990 Business Plan noted that `there is a need to reduce the rate of sickness and absence which is as high as 10 per cent in some areas. This is a key test for the new management teams in Passenger Services but there are already signs that it is achievable'. Manpower budgets include provision for staff absenteeism and an overall 4 per cent non-attendance rate is the current LUL target.

6.38. LUL has developed specific procedures on the basis of the guidance given in the ACAS Advisory Handbook, *Discipline at work*, in order to define standards and focus attention on the issue of non-attendance. A four-stage procedure for dealing with unsatisfactory attendance is initiated by centurion managers, who can administer cautions and written warnings which, if ignored, can lead to a disciplinary board and possible dismissal for persistent offenders.

6.39. As can be seen from the following tables, there are gaps in the relevant statistics. Rates of absenteeism have not improved during the past two years but have deteriorated, as Table 6.4 shows.

TABLE 6.4 **Percentage absence rates, 1987/88 to 1989/90**

Function/group	*1987/88*	*1988/89*	*1989/90*
Train drivers	8.4	7.2	9.8
Guards		10.7	
Station staff		10.4	8.8
Booking office		6.8	6.4
Operations (PSD) supervisory	7.5	7.5	N/A
Depot engineering workshop staff	8.8	8.5	N/A
Permanent way	8.0	7.3	5.0
Lifts/escalators	5.3	6.7	8.7
Cleaning services	6.8	4.8	8.2
Signals	5.5	7.2	5.0
Overall rate	5.9	7.4	7.7

Source: LUL.

6.40. High absence levels are usually associated with low staff morale. The rising level over the past two years may have been caused at least in part by the industrial relations problems culminating in the series of one-day strikes in 1989.

6.41. Table 6.5 is an analysis of absence rates by line.

TABLE 6.5 **Percentage absence rates by line, 1989/90 (1988/89 rates in brackets)**

	Line									
	Bakerloo	*Central*	*C&H*	*District*	*ELL*	*Jubilee*	*Met*	*Northern*	*Piccadilly*	*Victoria*
Train staff	7.87	8.05	8.14	5.87	12.42	8.95	12.32	14.61	5.76	N/A
	(7.48)	(6.76)	(8.86)	(5.64)	(5.99)	(6.10)	(5.43)	(7.97)	(4.89)	(7.97)
Station staff	8.61	8.77	6.39	7.82	8.96	12.38	9.24	8.97	8.06	N/A
	(12.94)	(9.32)	(4.80)	(7.15)	(11.25)	(8.90)	(9.32)	(7.40)	(6.67)	(9.21)
Booking office staff	8.93	5.35	6.63	7.00	7.75	8.42	4.63	6.67	6.11	N/A
	(7.91)	(5.99)	(3.86)	(4.90)	(3.40)	(5.49)	(3.67)	(6.36)	(4.60)	(4.56)
Fleet staff	12.80	8.72	13.80	N/A	0.19	-	13.74	13.83	8.65	N/A
	(10.39)	(4.54)	(5.33)	(13.77)	(3.08)	(-)	(6.53)	(8.87)	(5.84)	(7.89)
Overall line	8.58	7.02	7.92	N/A	8.81	8.81	8.27	10.32	6.42	N/A
	(8.07)	(6.50)	(6.24)	(6.57)	(6.14)	(5.91)	(5.46)	(7.34)	(5.01)	(6.24)

Source: LUL.

6.42. Apart from confirming the overall rise in absenteeism, Table 6.5 illustrates very high 1989/90 levels of absenteeism, for example among train staff on the Metropolitan (12.32 per cent) and Northern Lines (14.61 per cent) and among fleet staff on those lines (13.74 and 13.83 per cent). Absenteeism among drivers is a prime cause of train cancellations. A study by the Industrial Society published in the autumn of 1987, based on information from 275 companies throughout the United Kingdom, quoted a mean absence rate for the transport and communications industry of 8.97 per cent, the highest level of all the industry groups.

6.43. High rates of absence are often linked to high rates of labour turnover. LUL's overall rates of labour turnover have declined slightly from 12.07 per cent in 1987/88 to 11.48 per cent the following year and 10.56 per cent in 1989/90. We were told by LUL that the latest figure is around 7.75 per cent. Turnover rates on the lines in 1989/90 were highest on the Central Line (9.53 per cent) and the Northern Line (8.82 per cent). This may well be because these lines still employ guards, and as new employees tend to join LUL as guards, the concentration of such employees, with higher levels of labour turnover, is found here.

Conclusions and recommendations

Industrial relations

6.44. The bargaining and consultation machinery was due to have been reviewed and renegotiated between LUL management and the trade unions by April 1986. That negotiations have proved fruitless to date has been due partly to the complexity of the issues involved and partly to the continuing changes in the structure of LUL and the need to adapt any new machinery to take account of those changes. We conclude that the current situation, while clearly not critical, is unsatisfactory and not in the long term conducive to good industrial relations. We recommend that:

(a) LUL management and the trade unions should make a concerted effort to agree new bargaining and consultation machinery which is appropriate to the structural changes which have taken place in LUL; and

(b) in the event of continuing disagreement the parties should agree to a reference to ACAS.

Pay system

6.45. The current pay system is complex and we support and encourage the initiatives which LUL management are taking and have recently taken to simplify the structure. We conclude that:

(a) the introduction of performance-related pay for managers has been a positive step to relate individual pay to the achievement of objectives and also as a motivating factor and to enhance managerial performance;

(b) many of the bonus and incentive schemes currently in place for engineering wages grade staff are dated, fail to motivate staff, are difficult to understand and are extremely complicated in calculation;

(c) as a result in some cases bonus payments do not accurately reflect performance and the costs of bonus scheme administration are unacceptably high; and

(d) managers and supervisors need to take the initiative in managing the workforce rather than allowing the incentive schemes to do this for them.

We recommend that:

(i) LUL should continue its efforts to simplify the existing pay system; and

(ii) bonus and incentive schemes for wages grade staff should be reviewed jointly with the trade unions with the aim of simplification and of providing incentives to complete more work.

Recruitment

6.46. We conclude that, while recruitment of managers, school leavers and graduates is best retained centrally, the recruitment of wages grade staff by the personnel managers attached to the various line businesses would result in some staff savings at the centre, reduce staff transfers between lines and stations and be consistent with the continued devolution of personnel responsibilities. We recommend that LUL should consider devolving the recruitment of wages grade staff to local business units having due regard to costs and benefits.

Training

6.47. The volume of training carried out by LUL has increased markedly in recent years and it is generally well organised. We conclude that:

(a) some spare capacity exists which is often, but not always, utilised by LUL organising courses for other companies which are charged at cost;

(b) training is fragmented, taking place in a variety of locations some with out-of-date facilities; and

(c) plans to build a new vocational training centre which will centralise training in purpose-built surroundings may be a casualty of recently imposed financial restrictions.

We recommend that:

(i) the provision of a new vocational training centre is important and should be proceeded with as soon as finances allow; and

(ii) training courses for outside organisations should be priced competitively.

Absenteeism and labour turnover

6.48. We conclude that:

(a) despite management attempts to reduce them, absence levels in LUL remain high and have increased in the last two years with particularly high levels among train and fleet staff; and

(b) there are gaps in the relevant statistics which indicate inadequacies in monitoring and control procedures.

We recommend that statistics to assist the monitoring and control of absence and labour turnover should be available to all managers, together with training both in counselling skills and in the application of LUL procedures for dealing with unsatisfactory attendance.

7 Efficient use of manpower

Manpower numbers and costs

7.1. Employee numbers in LUL have been significantly reduced over recent years but, over the past two years, recruitment has accelerated so that overall numbers have increased and are now back to around 1986 levels-see Table 7.1.

TABLE 7.1 **Staff by main functions, 1986 to 1990**

	31.3.86	*31.3.87*	*31.3.88*	*31.3.89*	*31.3.90*
Passenger Services	12,702	12,466	11,675	11,762	13,080
Engineering	8,171	7,424	6,591	6,526	7,426
Central directorates	418	368	380	989	1,261
Police	307	354	346	368	412
Total	21,598	20,612	18,992	19,645	22,179

Source: LUL.

Staff numbers are still increasing and in November 1990 totalled 22,572 plus 687 temporary and consultancy staff.

7.2. While the restructuring of November 1988 and the establishment of line businesses makes past comparisons difficult, it is apparent from Table 7.1 that the relativities between the staff groups altered during the period 1986 to 1990. While all groups have shown recent increases, engineering staff are still below 1986 levels and passenger services, the staff who operate the trains, are just above their 1986 total. Police show an increase of some 34 per cent over their 1986 level, while central directorates have increased by over 200 per cent.

7.3. As to the reasons for these changes, LUL estimates that since the King's Cross fire the implementation of safety improvements and actions to improve asset health have increased overall staff numbers by some 1,700. In addition more administrative staff have been required to undertake reviews of all aspects of the service, to initiate and control various projects and to take over various functions in total from LRT. These devolved functions involved the transfer from LRT to LUL of around 500 staff, as shown in Table 7.2. Many of these functions are performed by LUL staff for LRT and, as a result, a proportion of their time is, strictly, spent on other than LUL business.

TABLE 7.2 **Functions devolved from LRT to LUL and numbers of staff transferred**

Year	*Function*	*Number of staff*
1988/89	Architects Division	86
	Payroll Services	135
	Management Development (including about 40 graduate trainees)	54
	Facilities (House) Management	30
	Welfare Services	16
	Equal Opportunities Unit	2
	Recreational Staff (sports)	8
	Advertising and Publicity	30
	Total for year	361
1989/90	Flagstaff Training and Conference Centre (including 21 wages grades)	25
	Distribution Services (including about 100 wages grades)	122
	Total for year	147

Source: LUL.

LUL estimates that staff in central directorates have increased by 745 since 1986 as a result of safety improvements, transfer of LRT functions and reallocation of some functions between directorates within LUL.

7.4. The central Personnel Directorate currently comprises some 560 staff. This includes instructors and residential staff at various training centres plus the trainees themselves, who together account for more than half the total. Over 200 staff are therefore engaged on personnel-related work. With the devolution of responsibilities to business units, personnel managers and related staff are now additionally established at line level. All lines have a personnel manager plus, in some cases, up to six assistants so that, together with significant personnel resources in the engineering function, there may well be up to a further 100 personnel staff in LUL, making a total in excess of 300.

7.5. Over the period from April 1986 to December 1990 LUL's accounting staff increased significantly (see paragraphs 4.77 and 4.78). This increase is in part accounted for by the devolution of functions from LRT to LUL (see Table 7.2). Staff transferred included payroll staff who provide a service throughout the LRT group. However, some of the increase appears to result from the devolution of some accounting activities to the Passenger Services and other subsidiary functions.

7.6. The trade unions allege that there are too many managers-some 2,300 managers and 300 higher managers. It is, however, acknowledged by LUL that the term `manager' is rather loosely applied and extends to lower levels than in comparable organisations. A recent review of management staffing levels carried out by consultants commissioned by LUL concluded that those levels `are now set at a reasonable level bearing in mind the nature of the company's operations'. It also commented on evidence of previous understaffing. These conclusions were reached after comparing numbers of similar managers, using job-evaluated data, across LUL, four commercially successful private sector companies and the New York City Transit Authority (to provide a comparable underground railway system). LUL emerged as having the next to lowest proportion of the total workforce occupied by management positions and the lowest proportion occupied by senior managers.

7.7. LUL's 1990 Business Plan was committed to achieving full station staffing levels and forecast an average staff total of 23,000 for 1990/91 (see Table 7.3). However, recent financial problems have resulted in reduced recruitment and a review of the continued employment of temporary staff in order to achieve the planned target. LRPC told us that it was strongly in favour of halting the progressive reduction in station staffing levels and maintained that the confidence and goodwill of passengers largely depended on LUL `presenting a human face'.

TABLE 7.3 **Average staffing levels (1990 Business Plan)**

	Budget 1990/91	*Plan 1991/92*	*Plan 1992/93*	*Plan 1993/94*	*Plan 1994/95*	*Plan 1995/96*
Passenger Services	12,582	12,971	12,914	12,819	12,727	12,446
Engineering	8,312	8,312	8,250	8,205	8,149	8,097
Central support services	2,106	2,155	2,194	2,220	2,251	2,276
Total	23,000	23,438	23,358	23,244	23,127	22,819

Source: LUL.

7.8. During our inquiry LUL revised its target staffing level at 1 April 1991 to 21,403, a figure some 1,000 staff lower than the current staff level. The main area of reduction will be in PSD where, because of operational and demand changes, LUL will reduce the number of booking clerks by 307, station staff by 180, guards by 144 and train operators by 72. Managers, clerks and inspectors show small increases. LUL hopes to achieve these reductions by natural wastage, voluntary severance, attractive early retirement terms and redeployment, thereby avoiding compulsory redundancies.

7.9. Following consultation and discussions with LRPC LUL told us that the number of staff affected would be nearer 800 rather than the 1,000 originally proposed. The staff savings would not, in the opinion of LUL management, result in a reduction in service to the public but rather in a more precise matching of service to demand and in increased productivity and efficiency and they should be seen as an element of the expected 10 per cent productivity savings over five years (see paragraph 7.40).

7.10. LUL later told us that, as part of the continuing process to assess potential improvements in efficiency, an estimation of what might be achievable in the longer term within PSD concluded that a further reduction of around 800 staff might be possible. LUL also told us that there were no detailed plans in place at the present time to implement these possible reductions as there were value analysis teams examining train, station and train maintenance staff activities which would provide confirmation, or otherwise, of the estimate. The estimate was contained in a confidential internal discussion document a copy of which had been `leaked' to the trade unions, who alleged that both programmes of staff reductions were panic measures prompted by financial problems, were therefore unplanned and would inevitably lead to an inferior service to the public.

7.11. Staff costs are forecast at around £450 million for the 1990/91 financial year. Table 7.4 details movements in staff costs.

TABLE 7.4 **Staff costs, 1985/86 to 1989/90**

				Indices			
Year	*Total staff costs £'000*	*Average staff*	*Costs per employee £*	*Costs per employee*	*LUL annual wage award*	*RPI*	*Average earnings SE region: manual and non-manual*
1985/86	276,748	21,857	12,662	100	100	100	100
1986/87	287,712	21,024	13,685	108.1	105.2	103	109.1
1987/88	283,682	19,754	14,361	113.4	110.0	107	121.6
1988/89	303,489	19,126	15,868	125.3	115.6	114	134.2
1989/90	370,404	21,010	17,630	139.2	125.7	123	147.9

Source: LUL/*New Earnings Survey*.

Costs per employee have risen during the period by 39.2 per cent compared with a rise in the RPI of 23 per cent and in average earnings in the South-East of 47.9 per cent.

7.12. Within LUL the job of train operator is used as a bench-mark for blue-collar occupations and Table 7.5 indicates that average weekly earnings, although starting from a considerably higher base due to overtime and allowances, have not risen as quickly as earnings for male manual jobs in the South-East.

TABLE 7.5 **Bench-mark comparison-earnings, 1985/86 to 1989/90**

	Train operator		*Male manual SE region*	
Year	*Average weekly earnings* £	*Index*	*Average weekly earnings* £	*Index*
1985/86	266.65	100	184.70	100
1986/87	276.88	103.8	196.20	106.2
1987/88	291.12	109.2	213.90	115.8
1988/89	333.58	125.1	233.50	126.4
1989/90	364.22	136.6	255.30	138.2

Source: LUL/*New Earnings Survey*.

7.13. Table 7.6 gives examples of average weekly gross earnings for wages grades staff, in 1989/90, showing the proportion of gross earnings represented by overtime and unsocial hours payments.

TABLE 7.6 **Wages grades-average weekly gross earnings, 1989/90**

£

	Train operator	*Guard*	*Booking clerk 1*	*Station foreman B*	*Permanent way skilled operator*	*Automatic equipment technician*
Basic	237.05	160.76	194.20	139.95	156.84	256.48
London Weighting allowance	21.63	21.63	21.63	21.63	-	21.63
Overtime/unsocial hours payment	105.54	71.57	100.34	87.82	103.64	115.74
Bonus	-	-	-	-	54.22	69.24
Work study allowance	-	-	-	-	-	7.51
OPO allowance	-	-	-	10.50	-	-
Total	364.22	253.96	316.17	259.90	314.70	470.60
Proportion of total pay represented by overtime and unsocial hours payments	30	28	32	34	30	*per cent* 24

Source: LUL.

7.14. High levels of overtime are found throughout the transport and communications industry (an average of 12.1 hours per week for manual male workers according to the *New Earnings Survey* 1987). In LUL work on Sundays and Bank Holidays is paid at double time and rostered hours outside 07.00 to 18.00 also attract premium rates. As a result the proportion of total pay represented by overtime and unsocial hours payments is broadly comparable to BR's NSE and Provincial sectors reported on in previous MMC inquiries.[1]

7.15. Using train operators as an example, Table 7.7 illustrates the extent of overtime and unsocial hours payments by line, operators receiving on average some 54 to 57 hours' pay for a rostered week of some 44 to 45 hours.

[1] *British Railways Board: Network SouthEast*, Cm 204, published in 1987 and *British Railways Board: Provincial*, Cm 584, published in 1989.

TABLE 7.7 **Train operators: average rostered hours worked and paid**

Line	Rostered (incl. Sunday) (hours:minutes) Worked	Paid
Bakerloo	43:53	54:29
Central*	44:28	56:14
Circle and Hammersmith	44:14	55:32
District	44:06	55:10
East London	45:02	57:24
Jubilee	43:53	55:14
Metropolitan	44:04	55:55
Northern	43:50	55:16
Piccadilly	43:57	55:04
Victoria	44:16	56:19

Source: LUL.

*West Ruislip only.

7.16. Overall control of overtime appears to be less than satisfactory. Owing to recent financial stringencies a four-weekly overtime analysis was instituted in August 1990 to examine overtime hours worked and paid plus overall costs. We were told that the collation of the necessary data is still evolving and that the reports, therefore, do not yet cover all areas of LUL.

7.17. Table 7.8 shows the costs of overtime working in LUL, including payment for unsocial hours, over five four-week periods at the end of 1990.

TABLE 7.8 **Overtime costs, 1990**

£

	Period 5	Period 6	Period 7	Period 8	Period 9
(a) Salaried staff					
Central directorates	67,831	71,986	36,789	87,213	53,347
PSD	300,679	98,348	7,597	20,456	52,773
Client engineering	110,500	110,500	110,500	56,095	63,489
Engineering operatives	87,196	87,627	58,990	99,774	82,378
Total	566,206	368,461	213,876	263,538	251,987
(b) Wages staff					
Central directorates	N/A	2,386	2,057	19,246	2,075
PSD	181,601	160,626	81,635	191,940	106,462
Client engineering	87,800	87,800	87,800	71,400	55,533
Engineering operatives	487,815	546,074	589,801	452,971	429,709
Total	757,216	796,886	761,293	735,557	593,779

Source: LUL.

From these figures it is apparent that the overall trend of overtime costs is downwards and control appears to have been established. However, it is admitted by LUL that the quality of the data is dubious, an example being the omission of PSG overtime at some £190,000 per period. Overtime pay is one of the major components of wages drift in LUL.

7.18. The LUL Board decided in 1989 that regular reports on wages drift should be prepared and reviewed by the Board. The objective of the reports is to review staff costs and numbers and to monitor the achievement of financial targets based on payroll costs.

7.19. A report from the Director of Audit in January 1990 indicated that the current mechanism set up to monitor wages drift in LUL compared actual with budget wages costs in total only and therefore lacked any consideration of pay components such as basic, unsocial and overtime pay. Without evaluation of these components monitoring of wages drift was severely limited. LUL management admitted that their knowledge in this area was very weak. The report also drew attention to the difficulty of reconciling the

information on staff numbers supplied by unit personnel managers, the LUL payroll and the main personnel database, the Railway Personnel Information System (RPIS) (see paragraph 7.27).

7.20. At an audit committee meeting in November 1990 the problem appeared unresolved, with concern again being expressed that the causes of wages drift could not adequately be identified through the accounting system. Doubts were raised about the ability of SUTOR (which was still being developed) to analyse pay components; and the lack of a comprehensive IT strategy was also highlighted.

7.21. The latest wages drift report, for period 8 of 1990/91, recommends that each directorate should establish a focal point for tighter local control of staff numbers and costs, with particular regard to expenditure on recruitment, overtime and the employment of consultants. It also recommends that consideration should be given to employing new staff on fixed-term contracts.

Manpower planning

7.22. Manpower planning in LUL is a `bottom-up' process which begins at centurion manager level with regular four-weekly head counts of staff, comparing actual staff with budget and vacancies. Staff wastage is recorded, future requirements estimated and replacements requisitioned up to six months ahead. These figures are then scrutinised and collated by line managers and used by business management teams to draw up annual business plans, which include staff numbers and costs. These plans are then passed up through each directorate for approval and on to central Personnel Directorate and the LUL Board for ultimate scrutiny, approval and incorporation into the LUL Business Plan.

7.23. The process is acknowledged by some managers to have problems. RPIS is not yet able to provide sufficient details to assist in manpower planning at lower management levels and access to the system is very limited-there are only three access terminals on the Bakerloo Line. The Promotion, Transfer and Redundancy (PT&R) arrangements agreed with the unions severely inhibit accurate manpower planning, owing to constant, unforeseeable staff transfer requests between stations and lines under those arrangements. For example, the Central Line experiences about 10 per cent staff turnover each year due to such transfers.

7.24. Managers feel that financial considerations rather than operational needs are paramount, with line budgets subjected to frequent cuts but seldom to increases.

7.25. In an attempt to introduce a more professional approach to manpower planning, recent work involving the Institute of Manpower Studies at Brighton has been undertaken to produce a manpower model to assist with the calculation of manpower flows into and out of the system. Factors taken into account include retirement rates, wastage levels, promotion avenues and rates and recruitment forecasts. The model has been used on the Bakerloo Line to estimate future manpower requirements but has yet to be generally applied across the network.

7.26. The manpower planning function in the central Personnel Directorate was established two years ago and has so far completed only one annual round of monitoring line budgets to measure compliance with LUL corporate plans. Work currently in hand includes the development of manpower models for engineering and professional staff, together with models to attempt to deal with the stop/go recruitment cycles which have prevailed in recent years.

7.27. RPIS is an on-line personnel system holding the records of all current and many thousands of previous employees. Information available includes personal records, career histories, sickness, absence and discipline records and information on training. Security presents a difficulty-currently over 400 staff have access to RPIS-but there are four clearly defined levels of access and staff are graded accordingly. Training takes place on `mirror databases' so that access to the real system is restricted. There are currently 200 access points to the system, following increased devolution, and the level of access varies from line to line. Central Personnel feel that the optimum level is Business Manager but line managers would like to see greatly increased access down to and including centurion managers. Regular programmes available to users include details of sickness, absence, lateness, seniority, accidents and training. However, there are gaps in the available statistics, probably due to inputting problems, which LUL told us are being addressed (see paragraph 6.39).

Manpower utilisation

7.28. Over the years various projects have been carried out which have resulted in savings in both staff costs and numbers. Chief among these have been the introduction of UTS and OPO and the establishment of EOW.

7.29. The UTS project was approved in 1984 and had among its objectives a reduction in staff costs. Besides the installation of the new gates and ticket machines and the rebuilding of ticket offices the project involved negotiating staff acceptance of new procedures to cope with the new range of technologically advanced equipment. Projected benefits included savings of 671 staff. Whether this has been achieved is questionable as gates still require to be attended both for safety reasons and to assist with problems of passenger egress. Certainly many of the staff savings were overtaken by the need to increase staff following the King's Cross fire.

7.30. The OPO programme was implemented to reduce costs and to overcome train staff shortages, thereby increasing service performance and improving train staff output. A trial commenced in March 1984 on the Hammersmith and City Line and all other lines have since been converted with the exception of the Central and Northern Lines, which are due to be converted by the mid-1990s. A number of industrial relations hurdles were overcome to achieve this major change in working practices. Peak-hour train cancellations due to non-availability of staff are significantly lower on OPO lines.

7.31. EOW was opened in 1989 to replace the original facilities built in 1923. The opportunity was taken to enter into a new collective agreement with the relevant trade unions to increase staff flexibility, reduce the number of staff grades and update working practices, while at the same time gradually reducing the workforce from 1,200 to 700.

7.32. As a result of these and other changes productivity, measured as staff per million passenger miles, increased appreciably between 1984/85 and 1988/89, but fell back in 1989/90 owing to the significant increase in staff engaged on administration and safety improvements and to lost miles due to industrial action. Train miles operated per employee show a similar pattern over the same period (see Tables 7.9 and 7.10).

TABLE 7.9 **Number of staff per million passenger miles, 1984/85 to 1989/90**

1984/85	*1985/86*	*1986/87*	*1987/88*	*1988/89*	*1989/90*
6.7	5.9	5.4	5.1	4.9	5.6

Source: LUL.

TABLE 7.10 **Train miles operated per employee, 1984/85 to 1989/90**

1984/85	*1985/86*	*1986/87*	*1987/88*	*1988/89*	*1989/90*
1,328	1,359	1,455	1,610	1,678	1,513

Source: LUL.

7.33. There have been many indications in recent years, particularly from consultants, that there continues to be considerable scope for further efficiency improvements. Consultants have been extensively used by LUL and in a report of July 1989 on the operation of the central Personnel Directorate made recommendations to reduce the six departments of the directorate to three in order to eliminate confusion both within the directorate and amongst its customers. Currently the organisation remains unchanged.

7.34. Industrial action began in April 1989 as a result of a claim by the trade unions for an increase in train operators' pay independently of any further productivity-based measures, which they claimed had been agreed when OPO was introduced. In August 1989 an ACAS Board of Mediation examined the claim and as part of their report stated: `There are considerable opportunities for further increases in earnings following efficiency improvements and these too should be discussed by the parties.' JWPs on both train staffing and station staffing are currently in place but this aspect of the ACAS Board's decision, relating to train staff, remains outstanding. The unions believe that there is little scope outside the completion of the OPO programme for further reducing costs by changes in working practices.

7.35. The JWPs are undoubtedly considering complex staffing issues. For example, staffing levels on stations depend on the following factors:

- Under section 12 of the Fire Precautions (Sub-surface Railway Stations) Regulations 1989 two trained members of staff including a supervisor must be available on the station when it is open to the public (excludes Farringdon and Barbican).

- Under the same regulations inspections are to be completed every three hours-all rooms and areas to be checked.

- `Safe' levels of staffing for evacuation purposes.

- Adequate staffing levels to implement the congestion control plan (eg King's Cross `one way systems', emergency closure of platforms such as at Moorgate in the evening peak).

- Gatelines to be attended by at least one person whilst they are in operation.

- A member of staff (not booking office) to be within five seconds of an emergency plunger if a gateline is operable.

- Station Operations Rooms to be manned during traffic hours.

- Staff to be available during peaks for platform attendance (safety requirements and customer service).

- Excess fares windows to be manned, especially if gatelines are operable.

- Passenger operated ticket issuing machines (POMs) to be `floated'; ticket jams to be dealt with.

- Cash to be consolidated and prepared for banking.

- Booking office windows to be manned to meet customer demands.

- Staff to be available for patrolling the station throughout the day (eg checking escalators, seats, etc).

7.36. Sample station staffing levels at Liverpool Street in 1990 are shown in Table 7.11.

TABLE 7.11 **Sample station staffing levels, Liverpool Street, 1990**

		Notes
Station inspectors	6	Operations room manned for full traffic day, for patrols and for staff supervision
Leading rail staff	28*	Mainly gateline attendance
Leading rail staff	12*	Platform attendance
Supervisory booking clerks	4	
Booking clerks		
`A' office	3	
`B' office	8	
`D' office	5	(Due to close)

Source: LUL.

*Includes cover for rest days.

7.37. Numbers of train staff depend on the services to be run, with allowances for holidays, training and sickness. An analysis of duty turns by line is provided in Table 7.12.

TABLE 7.12 **Train staff: analysis of running turns of duty (Monday to Friday) by line, October 1990**

	Met	*City*	*ELL*	*Jub*	*Nthn*	*Vic*	*Dist*	*Picc*	*Cen*	*Bak*
Time on train	4.48	4.40	5.05	5.08	5.26	5.12	4.48	5.05	5.19	4.43
Reporting, preparing and disposing time	1.13	1.05	1.27	1.06	0.40	0.53	1.08	1.02	0.45	1.16
Meal relief	0.55	0.56	0.48	0.59	0.54	0.55	0.55	0.55	0.55	0.58
Travelling time	0.22	0.22	0.05	0.12	0.13	0.14	0.15	0.12	0.15	0.21
Change-over time	0.14	0.16	0.02	0.16	0.12	0.12	0.10	0.11	0.09	0.08
Station manager's instructions (on running turns)	0.11	0.04	0.07	-	0.10	0.05	0.14	0.02	0.10	0.06
Unused time	0.18	0.38	0.27	0.20	0.26	0.30	0.32	0.34	0.28	0.29
Average scheduled time per duty	8.01	8.01	8.01	8.01	8.01	8.01	8.02	8.01	8.01	8.01

Source: LUL.

Notes:
1. Figures quoted are hours and minutes.
2. Northern and Central Lines are not OPO.

7.38. A further step in improving productivity came in July 1989 with the formation of an in-house group of specialists to examine potential areas of cost saving (a task previously undertaken by various outside consultants). The Resource Evaluation Group (REG) was established `to optimise the efficiency, productivity and utilisation of all the resources of LUL including staff etc'. Its main objective was to achieve a savings ratio of 4:1 per annum against its costs. It is an advisory body reporting to senior management, with no mandate to implement its recommendations.

7.39. Since its formation REG has issued over 60 reports covering a wide range of LUL activities. At 17 September 1990 it had recommended savings of 395 staff posts (average cost £20,000, total value £7.9 million per annum) across various directorates but to date savings of some 42 posts only have been implemented. We were told by various managers that the reasons for non-implementation were:

(a) all staff reductions had to be negotiated with the unions and this could take years;

(b) there was no incentive for individual managers to make what amounted to additional voluntary cuts in their departments if they were already within their agreed staff budgets; and

(c) there was some animosity and resentment towards REG and its recommendations, owing to its approach and working methods.

7.40. In August 1990 REG issued a report entitled *Improving productivity within the directorates of London Underground Ltd,* an all-embracing analysis relating to LUL's objective to improve overall productivity by 10 per cent over a five-year period. This objective was outlined in the 1990 Business Plan, which identified scope for productivity gains in all areas. The REG report envisages a total staff reduction of 2,300 over a five-year period and an ultimate staff level of 21,000. Moreover, the report identifies scope for still further reductions, such that a 10 per cent improvement should be a minimum target. The report also draws attention to problem areas requiring resolution in order to effect these gains:

(a) union restrictive practices and resistance to change;

(b) acceptance of custom and practice;

(c) low expectations on the part of management;

(d) high rates of absence; and

(e) low productivity of staff.

7.41. The report suggested a phased programme with the objective of achieving staff savings as indicated in Table 7.13.

TABLE 7.13 **Summary of expected improvements, REG report, August 1990**

Directorate	*Division*	*Staff*	*Improvement %*	*Savings*
1. Passenger Services	Train staff	3,457	10	346
	Station staff	4,935	10	494
	Fleet staff	1,795	20	359
2. Passenger Services Administration/Management	-	1,321	20	264
3. Engineering Operations	Permanent way	1,659	15	249
	Permanent way workshop	385	15	58
	Mechanical engineering workshop	702	20	140
	Lifts/escalators	559	15	84
	Signals/electricals	1,907	10	190
	Cleaning	463	5	23
4. Directorates	Finance	349	15	52
	Payrolls	134	15	20
	Personnel	691	15	103
	Safety Services	43	10	4
5. Client engineering	-	2,610	10	261
Total		21,010	13	2,647

Source: LUL.

LUL told us that this programme is currently under consideration by senior management as part of the recently announced value analysis initiative (see paragraph 7.46).

7.42. A previous REG report of November 1989 on train staffing mentioned the prevalence of `unofficial customs and practices' which had developed over years following a system of `give and take' to the mutual benefit of both management and staff. The report alleged that arrangements had degenerated into a situation of `all take' on the part of the staff with very little `give'. Practices introduced as concessions had over the years become regarded as rights. Examples were given of unrecorded lateness, manipulation of break times, poor utilisation of stand-by staff and allowing such staff to leave early.

7.43. LUL told us that such unofficial practices were difficult to identify without detailed examination of actual work practices at local level. However, it was able to amplify the examples given in the REG report: practices currently prevalent among train crew are:

(a) leaving work on completion of a rostered duty but before the scheduled end of a shift;

(b) non-recording of lateness;

(c) arriving late then picking up the rostered train brought into service `unofficially' by a spare crew; and

(d) the introduction of spare crew to allow for physical needs reliefs.

LUL admitted that these were practices which local management had failed to control but attributed this to the lack of managerial staff in the past. It said that it had now increased the number of local managers and was thereby endeavouring to exert greater control over these practices.

7.44. It was also contended by LUL that various agreements negotiated with the trade unions constrained productivity:

(a) Train staff:

- fixed shift length of eight hours;
- two-person preparation of OPO trains for service;
- rostered Sunday duties where staff work to `Station Manager's Instructions' (SMI); and
- nomination systems within PT&R.

(b) Station staff:

- inflexible and complex grading structure;
- full-time staff only employed;
- fixed shift lengths; and
- nomination systems within PT&R.

(c) Engineering staff:

- fixed shift lengths/patterns;
- `negotiated' times within incentive schemes; and
- conciliation and workshop staff demarcation.

7.45. LUL admitted that very little was being done at present to negotiate changes to the various agreements as the JWPs for both train and station staff had ceased to meet and had no plans to reconvene in the foreseeable future, as a result of the recently announced programme of staff reductions (see paragraph 7.8). Additionally management conceded that LUL's ability to change agreements with its staff by negotiation was not good. The unions made the point that the agreements were made between LUL and the relevant unions and that at the time they were made they must have been regarded by both sides as desirable, or at least acceptable, agreements. The unions professed themselves ready to discuss and negotiate on all these issues providing that safety, fatigue and stress factors were taken into account.

7.46. In December 1990 the LUL Board approved the implementation of a value analysis project aimed at cost reduction and efficiency improvement without detriment to customer service. The chief targets for identification by the value analysis teams now being set up throughout LUL will be low-value tasks which are no longer needed; ways of carrying out high-value tasks at lower cost without reducing performance; and options for restructuring roles and responsibilities. The teams are being assisted by external consultants. The role of each team will be to review a particular `value target', which may be a directorate, function, process, job, asset or work method. Teams will not have executive authority to implement improvements but will make recommendations to a Steering Committee chaired by the Managing Director. As current REG projects are completed REG staff will become part of the value analysis project, which is to be completed by 30 September 1991.

7.47. Other measures in progress to promote greater efficiency include SUTOR and Time Attendance Recording (TAR). The computerised payroll system, SUTOR, is to be introduced in early 1991, initially for train staff in PSD, to assist the accurate rostering and payment of staff. However, there are doubts within LUL about its effectiveness (see paragraph 7.20).

7.48. TAR replaces the existing clock card system at rolling stock depots and will be in place by 1992. It will produce pay, overtime, sickness and absence details. Besides improving overall efficiency it is anticipated by LUL that the introduction of TAR will result in some staff savings among administration staff.

7.49. Performance indicators are being developed in administrative areas so that trends can be monitored and internal and external comparisons made. In the central Personnel Directorate, for example, these indicators cover recruitment costs and delays, management training costs and vocational training costs. Individual departments and sections within the directorate are also subject to performance control which ensures a close match between workload and staff numbers.

Contracting out

7.50. The current practice of LUL is to carry out maintenance and renewals work in the majority of cases with its own internal workforce. Around 5,700 staff under the Director of Engineering Operations are required to operate as business units which should compete with external contractors, on an `earn or starve' basis, thus complying with the provisions of the LRT Act (see paragraph 3.20). These arrangements were developed to enable LUL to test the market to determine whether work should be done externally or remain in-house.

7.51. Management's view is that while there may be activities which could be carried out by external contractors, if in-house contractors prove their competitiveness they should continue to provide the service. Furthermore management are clear that it is necessary to retain a viable level of in-house resource and expertise in many areas of maintenance, not only to improve the company's own technical knowledge, but also to act as a control on the external market. The result of this policy is that after the proposed devolution of routine maintenance to line businesses the annual value of contracts is expected to be as shown in Table 7.14.

TABLE 7.14 **Annual value of contracts after proposed devolution of routine maintenance to line businesses**

£ million

	Internal	*External*	*Total*
Maintenance/renewals	130	30	160

Source: LUL.

7.52. Senior management's view is that the aggressive character of this policy is to a large extent self-defeating in that the potential exists for Engineering Operations to lose all its work and therefore all its staff; while individual managers view the possible demise of their own functions with little enthusiasm.

7.53. Every attempt to place work externally becomes an industrial relations issue strongly resisted by the trade unions. They are very much opposed to the contracting out principle and have made their views plain at meetings of the Competitive Tendering Joint Working Party set up in January 1988. They are concerned that the result of the policy could be that all activities would eventually be carried out by non-LUL staff. They also consider that the policy encourages `cutting corners' to retain work in-house and that external contractors without railway expertise and experience may create a safety hazard for themselves and LUL staff. The unions maintain that the conflict between economic and safety issues is very real.

7.54. Allegations that external contractors often use LUL contracts as `loss leaders' in order to gain a foothold in LUL are made by the unions. Examples are quoted where accepted low tenders by external contractors ultimately cost as much as internal tenders, suggesting contracts won unfairly by external contractors quoting unrealistic prices.

7.55. The LUL Board in late 1989 set up a sub-committee to carry out a sourcing review. In early 1990 members of this sub-committee visited 12 Metro railway operators around the world to gather data about their policies and practices.

7.56. From the evidence collected they concluded that at the blue-collar level in Engineering Operations Directorate LUL appeared to be overmanned; that in other railways restrictive labour practices generally forced management to contract out whenever they could in order to respond to pressures on costs; and that wherever work was contracted out costs were significantly lower than those of the in-house labour force. At the time the visits were made levels of productivity in the other, invariably more recent, railway systems seemed in many cases to be much higher than LUL. As regards lifts and escalators the number of units maintained per employee ranged from three to eight and availability between 96 and 98 per cent. This compares with LUL's present performance of one unit per employee and availability of less than 85 per cent. As to permanent way LUL has six men per route mile, compared with Paris Metro's three men and several of the smaller railways' one man per route mile. Comparisons with these systems should, however, be viewed with caution because of the greater age of LUL's system and equipment and the physical constraints of deep-level tube operation.

7.57. Subsequently LUL management told us that they have been pressing ahead to bring forward further proposals for increasing competition in all areas of engineering maintenance and renewals work. Table 7.15 details the distribution of contracts for main areas of work in 1989/90.

TABLE 7.15 **Distribution of contracts, 1989/90**

£ million

	Internal		*External*		
Area of work	*Maintenance*	*Renewal*	*Maintenance*	*Renewal*	*Total*
UTS	2.5	-	1.7	-	4.2
Lifts/escalators	17.4	-	3.4	3.0	23.8
Cleaning	8.5	-	7.5	-	16.0
Permanent way	28.0	13.0	-	-	41.0
HV power supplies	5.3	0.2	0.3	3.0	8.8
Signals/electrical	23.6	9.1	0.6	12.0	45.3
Total	85.3	22.3	13.5	18.0	139.1

Source: LUL.

Conclusions and recommendations

Manpower numbers and costs

7.58. The rapid increase in the number of administration and management staff in recent years is partly due to a deliberate policy by LUL to strengthen management and partly due to increases brought about by safety requirements post-King's Cross and by the transfer to LUL of some LRT functions. Despite

devolution of certain responsibilities to line businesses the staff of central directorates now totals over three times the 1986 figure. We conclude that:

(a) a detailed examination of posts and responsibilities would be required to ascertain whether or not overmanning is significant, which LUL admits may well be one result of its recent value analysis initiative;

(b) increases in staff costs are reasonable over the past five years when compared with the RPI and average earnings in the South-East;

(c) overtime and unsocial hours payments represent a high proportion of total pay but are broadly comparable to those of BR; and

(d) the monitoring and control of overtime and the identification and control of other elements of wages drift is unsatisfactory.

We recommend that:

(i) an in-depth examination of manning levels and responsibilities in the central directorates should be undertaken by September 1991 as part of the value analysis initiative;

(ii) an independent outside review of LUL's accounting staff requirements should be carried out, having regard to the financial and accounting tasks which need to be undertaken, as soon as devolution is in place and not later than 1992/93; and

(iii) overtime, particularly unrostered overtime, should be monitored and controlled more effectively and action taken by the end of 1991 to identify the components of wages drift.

Manpower planning

7.59. A corporate manpower planning function was established in LUL only two years ago and RPIS, which should provide the necessary database, is still being developed. We were told that significant progress had been made including the adoption of a manpower model for the Bakerloo Line and that work was currently in hand to develop further models for other areas in LUL. Nevertheless, we conclude that:

(a) RPIS is unable to provide all required data to assist manpower planning; and

(b) all managers do not have ready access to the system.

We recommend that the development of RPIS should be continued so that all relevant personnel data essential for manpower planning purposes are readily available to managers throughout LUL by mid-1992.

Manpower utilisation

7.60. Considerable staff savings have been achieved in recent years, chiefly by the introduction of OPO and UTS. LUL is considering a programme to improve overall productivity by 10 per cent over a five-year period and has recently introduced a value analysis initiative to help identify areas where progress can be made principally by enabling local managers to organise their staff to suit local conditions. We conclude that:

(a) savings have been in part offset by the recent need to increase staff for safety purposes;

(b) as a result, productivity, as measured by the number of staff per million passenger miles or by train miles operated per employee, fell back in 1989/90 following consistent improvement since 1984/85;

(c) LUL's REG has identified a number of areas where staff savings might be possible but its recommendations need more detailed analysis and as a consequence have not yet been implemented;

(d) customs and practices which constrain productivity are prevalent in certain areas and in some instances are condoned by local managers who have abdicated responsibility to the workforce; and

(e) negotiated collective agreements contain terms which, in themselves, may inhibit further improvements in productivity.

We recommend that:

(i) LUL, through the value analysis initiative and local management, should examine thoroughly the scope for further staff savings and efficiency gains, for example in the area of flexible rostering for train staff;

(ii) LUL should enter into negotiations with the trade unions over those items currently in collective agreements which may constrain productivity; and

(iii) the LUL productivity target improvement of 2 per cent each year on average over five years, which we note and consider to be reasonable, should be seen as a minimum target to be achieved.

Contracting out

7.61. The bulk of maintenance and renewals work is carried out in-house. From an annual total value of £160 million, internal contracts account for £130 million and external contracts £30 million. The trade unions and some local managers are opposed to the principle of competitive tendering. We conclude that:

(a) competitive tendering promotes competition for work and thereby encourages increased efficiency and productivity; and

(b) safety must remain of paramount importance and LUL must be satisfied that the safety of its own staff and its customers is not in any way compromised by the use of external contractors.

We recommend that LUL should pursue a policy of increasing competition in all areas where external contractors are competent to tender for work and can operate within LUL-defined and controlled safety standards.

8 Operational capacity and management of existing resources

Introduction

8.1. In this chapter we first give a brief description of the LUL system and its assets as a whole. We then examine in more detail the rolling stock fleet, its maintenance and reliability; the permanent way, its condition and the maintenance and renewal arrangements; signal and control systems including maintenance and renewal; and, similarly, lifts and escalators. Other engineering aspects including structures, pumps, drainage, power supply and ticketing equipment are considered more briefly. The chapter ends with a review of the arrangements for the day-to-day management of the services and the factors affecting the quality of service provided. These matters are illustrated where appropriate by material drawn from our case studies of the Central and Metropolitan Lines.

The system

8.2. When incorporated in 1985, LUL inherited a railway system of which the oldest parts began construction in the 1860s and the newest parts in the 1970s. It extends over 254 route miles, of which 105 route miles are in tunnels, and serves 248 LUL stations plus 25 BR stations. All but 15 route miles are double track or more, giving a total length of track open to traffic of 680 miles. The system is divided into ten lines, all except the Victoria Line being above surface at their outer ends, but either sub-surface or deep tube lines in the centre. The District and Metropolitan Lines are examples of sub-surface lines, both running in cuttings which have been covered and built over. The Central, Victoria and Northern Lines are examples of deep tube lines running in concrete or, mainly, cast-iron lined, small diameter tunnels bored well below surface level. The average depth of tube lines below ground level is 80 feet, with the deepest point on the Northern Line, at 221 feet. Individually the lines range from the 4-mile long East London Line with seven stations, to the Central Line, 52 miles long and serving 51 stations.

8.3. LUL carries some 800 million passengers a year and has 3,880 passenger cars mainly made up into trains of six, seven or eight cars each. The daily peak services require a total of 477 trains. While of various ages and types (see Appendix 8.1) the rolling stock fleet can be broadly divided between trains suitable for the sub-surface lines and those suitable for the tube lines. The latter have smaller external dimensions to fit the tunnels.

8.4. Some 70 per cent of LUL's power needs are generated by its two power stations, the balance being obtained from the National Grid via London Electricity Plc.

8.5. Access to trains on the deep tube lines is provided by escalators, stairs or lifts. LUL has a total of 274 escalators at 69 stations and 70 lifts at 26 stations. The vertical distance covered by escalators ranges from 15 feet to 80 feet and by lifts from 30 feet to 181 feet. LUL would prefer to replace lifts by escalators where physically possible but this can rarely be economically justified.

8.6. Apart from its stations, tunnels and track, LUL is responsible for some 1,500 bridges, covered ways and girderings, 12 major train depots, five workshops and a number of office and other buildings.

8.7. In the following paragraphs we discuss LUL's arrangements and performance in the engineering maintenance of its assets. These should be seen in the context of LUL's aim to upgrade the system (Business Goal 4-see paragraph 8.171) and its application for quality standard certificates under BS 5750.

Rolling stock

8.8. Details of LUL's passenger rolling stock fleet are given at Appendix 8.1. As noted earlier (paragraph 8.3), the fleet comprises a total of 3,880 passenger cars, of which 1,176 are surface stock and the balance tube stock. The cars are made up into two-, three- or four-car units with a driving cab at one end, sometimes at both ends. For most services units are coupled together to provide six-, seven- or eight-car trains. However, ten of the 477 trains used in the peak periods are single units of three or four cars. Peak services require the use of 3,251 cars, or 84 per cent of the fleet. The Northern Line has a mixture of stock, not all of which is compatible. The oldest stock in service is the 1956 stock on the Northern Line and the newest is the 1983 stock on the Jubilee Line.

8.9. Professional responsibility for the condition of LUL's rolling stock rests with the Rolling Stock Engineer (RSE), who reports directly to the Engineering Director. The RSE is the `client' engineer (see Chapter 3) and determines maintenance policy and sets maintenance standards, particularly in relation to safety. Performance against these standards is monitored by periodic audits including a safety audit on 2 per cent of the fleet each year. The RSE signs the annual fitness certificate for rolling stock.

8.10. Responsibility for undertaking the overhaul, maintenance and cleaning of rolling stock on each line rests with the LGMs and is delegated to the Fleet Managers and Depot Managers. Two exceptions to this are the East London Line with only seven trains allocated to it and the Jubilee Line. For these lines the maintenance function is exercised by the Fleet Manager of the Metropolitan Line.

8.11. LUL has a total of 12 main rolling stock depots, as shown in Appendix 8.2. Four lines have two depots each and four lines one depot each. Two lines, the East London and the Jubilee, do not have a dedicated main depot, stock being maintained at the Metropolitan Line Neasden depot, although for the East London Line 14-daily examination work is carried out at New Cross depot. In addition the Hammersmith depot maintains stock used on the District Line Edgware Road to Wimbledon service. Apart from the main depots most lines have one or more minor depots or sidings where stock is stabled overnight and routine maintenance and cleaning undertaken.

8.12. The overhaul, maintenance and cleaning of rolling stock is planned on the basis of specified time intervals which vary with the type of stock. Appendices 8.3 and 8.4 show the scheduled maintenance intervals for trains and rotating machines (for example, traction motors), while Appendix 8.5 sets out the cleaning cycle. All trains undergo a nightly test of specified safety devices and all should receive a nightly sweep and dust of car interiors and cleaning of driving cab windows. The nightly work is undertaken in depots or at stabling points as appropriate while all other work is undertaken at a main depot.

8.13. In addition to planned maintenance work, depots also undertake casualty repair work. Casualties are defined as rolling stock failures in service but also include failures which prevent rolling stock going into service and work arising from an examination which results in the stock being withheld longer than planned.

Rolling stock availability

8.14. The rolling stock owned by each line is shown at Appendix 8.1, excepting the East London Line. The stock for this line is included in the Metropolitan Line figures of 56 eight-car trains. Three of these are required to operate the East London Line peak services, run as six four-car units. Apart from this exception the number of trains owned by each line exceeds the peak service timetable requirement so as to allow for planned maintenance and other factors.

8.15. LUL told us that the factors taken into account in determining the level of spare trains were:

(a) the size of homogenous fleet on a line-the smaller this was, the larger the percentage spares margin tended to be;

(b) the number of homogenous stock types or their variants on a line-more than one stock type on a line tended to result in a larger spares margin than for a single homogenous fleet;

(c) rolling stock on the Central, Circle and Hammersmith, Metropolitan, Northern and Piccadilly Lines becomes turned because of loops on these lines. The effect of this is minimal on Circle and Hammersmith Line trains, where all units have operative driving cabs which are completely reversible, but is severe on the Northern Line trains, where units can only be coupled to other units the same way round and only half of the driving cabs can be used at the outer ends of trains;

(d) the Bakerloo, District, Metropolitan, Piccadilly and Victoria Lines all suffer from restrictions in re-forming trains because of the limited number of operative driving cabs provided;

(e) the Bakerloo and Northern Lines have further restrictions on re-forming trains because they are equipped with asymmetrical three- and four-car units to form seven-car trains; and

(f) the extent and timing of the routine, heavy programmed and casualty maintenance that is required.

8.16. Table 8.1 shows the maximum scheduled trains in peak service for each line both as a number and as a percentage of the fleet owned.

TABLE 8.1 **LUL scheduled train availability, November 1990**

Line	*Trains owned Number*	*Peak service Number**	*Requirement %*
Bakerloo	33	29	87.9
Central	86.5	76	87.9
District	75	67	89.3
Circle and Hammersmith	46.3	40†	86.3
Jubilee	31.5	28‡	88.9
Metropolitan	53	43§	81.0
East London	6	6	100.0
Northern	105.9	87	82.1
Piccadilly	87	74	85.1
Victoria	43	37¶	86.0
Network average			85.9

Source: LUL.

*All peak service figures include one spare train.
†Includes nine trains for the District Line, Edgware Road to Wimbledon service.
‡Currently reduced by three trains through planned cancellations due to rolling stock non-availability.
§Reduced by two trains from May 1990 to provide stock for refurbishment.
¶Currently reduced by six trains through planned cancellations due to rolling stock non-availability.

8.17. For LUL as a whole the margin of spare trains to allow for preventative maintenance and other factors noted above is 14 per cent of the fleet owned. On individual lines it ranges from nil on the East London Line to 18 and 19 per cent on the Northern and Metropolitan Lines. The scheduled train availability also includes one spare train for each line to meet operational contingencies. Table 8.2 summarises cancellations due to no rolling stock or defective trains in the morning peak for the first eight periods of 1990/91, expressed as a percentage of the scheduled service.

TABLE 8.2 **Scheduled trains cancelled in the morning peak, periods 1 to 8, 1990/91-defective trains/no rolling stock**

per cent

Line	*Period 1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Bakerloo	1.4	1.2	1.1	0.9	2.0	0.4	0.7	0.9
Central (main)	2.3	3.5	1.4	3.0	3.9	1.8	2.4	2.9
(shuttle)	0	0	0	0	0	0	0	0
District (main)	1.9	0.8	1.3	17.0	6.3	5.3	3.7	1.5
(Edgware Road)	0	0	0.6	0	6.1	0.6	0.6	0
Circle and Hammersmith	2.0	1.0	1.4	2.8	6.3	3.7	3.5	5.8
Jubilee	13.8	5.8	8.8	11.8	13.1	5.8	11.7	4.6
Metropolitan	7.3	3.7	3.4	3.7	3.2	1.4	2.6	1.2
East London	0	0	0	1.0	0	0	1.0	0
Northern	3.0	3.4	4.5	2.6	1.8	1.2	1.0	0.5
Piccadilly	4.4	3.6	1.7	2.1	1.7	1.9	1.8	2.5
Victoria 8.5	5.0	6.9	8.3	24.9	21.5	17.2	26.0	
All	4.1	3.0	2.9	5.5	5.6	3.9	4.0	3.9

Source: MMC study.

8.18. With a scheduled service requiring 477 trains in the peak, 4 per cent represents 19 trains cancelled owing to lack of rolling stock alone. Cancellations also occur for other reasons, particularly lack of crew. As can be seen from Table 8.2, the best performance was achieved on the Central Line shuttle service (three trains) and the East London Line (five trains). The District Line suffered a high rate of cancellation in period 4 and subsequently, following the failure of motor brackets which required modifications to all trains in its fleet. A similar problem has arisen more recently on Piccadilly Line stock.

8.19. Over the period covered by Table 8.2 the highest level of cancellations occurred on the Jubilee and Victoria Lines. The scheduled peak services on these lines have now been reduced by three and six trains respectively because of continuing problems. On the Jubilee Line, with the newest stock (1983), certain items of equipment have proved to be of relatively poor design and not capable of performing the required duty with acceptable reliability. LUL told us that considerable maintenance effort, including overhaul of motor alternators earlier than planned, had failed to resolve the problems and it appeared likely that new equipment would be necessary.

8.20. On the Victoria Line excessive wheel and rail wear has occurred, with the result that on some days as many as 16 trains out of the scheduled 36 have not been available. LUL told us that this had been an extremely difficult matter to resolve and that initially it had concluded that the track gauge had narrowed, leading to wear on rails and wheel flanges. The narrowing was attributed to shrinkage of the timber sleepers due to the prolonged periods of unusually low humidity in 1989 and 1990. It is now clear that this problem was aggravated by a combination of track tightening and a change of brake block material. LUL has now taken steps to correct the identified faults.

Rolling stock reliability

8.21. Rolling stock reliability is measured in terms of failures causing a delay of two minutes or more in service. Performance is reported as the number of such incidents per 10,000 passenger train miles. Table 8.3 summarises the annual performance, by line, for the last five years.

TABLE 8.3 **Rolling stock failures causing a delay of two minutes or more per 10,000 passenger train miles**

Line	*1985/86*	*1986/87*	*1987/88*	*1988/89*	*1989/90*
Bakerloo	7.41	7.25	6.46	6.09	5.53
Central	2.21	1.90	2.40	2.17	3.71
District	2.06	1.64	1.88	2.21	3.03
Jubilee	3.68	5.49	7.08	4.95	12.05
Metropolitan*	1.53	2.06	1.78	2.78	4.48
Northern	2.85	3.60	4.16	4.80	7.29
Piccadilly	2.17	3.65	5.37	5.11	3.99
Victoria	3.56	4.05	5.15	2.91	5.95
All	2.57	3.10	3.65	3.91	5.10

Source: LUL.

*Incorporates Circle and Hammersmith and East London Lines.

8.22. Table 8.3 shows a declining trend in performance over the five years, with the worst performance on the Jubilee Line (see paragraph 8.19). More recently the rate of failures has improved but remains at a high level. Table 8.4 shows the performance for the four weeks ended 10 November 1990.

TABLE 8.4 **Rolling stock failures causing a delay of two minutes or more per 10,000 passenger train miles, 14.10.90 to 10.11.90**

Bakerloo	2.60
Central	1.91
District	4.25
Circle and Hammersmith	5.41
Jubilee	7.48
Metropolitan	3.20
East London	4.15
Northern	4.32
Piccadilly	3.61
Victoria	15.69
All	4.62

Source: LUL.

Note: As can be seen, most lines have shown some improvement but the Jubilee Line failure rate remains high and the Victoria Line's has increased dramatically.

8.23. LUL pointed out that this monitoring system only captures data relating to incidents causing service delays of two minutes or more. There are also train equipment failures which do not cause delays and others which are found during planned maintenance. All require maintenance attention, usually unscheduled, and this affects the number of trains tied up in casualty maintenance, thus influencing train availability.

8.24. LUL also reports defects causing failures giving rise to delays in service, recorded by type of equipment. In 1989/90 defects in electrical and electronic equipment accounted for most failures, at 61 per cent of the total. Traction control equipment was the most affected item, at 12 per cent of the total.

8.25. The proportion of defects arising in different types of equipment varied between types of stock and between lines. For example, for the 1983 tube stock on the Jubilee Line some 73 per cent of defects were in electrical and electronic equipment and only 13 per cent in door equipment. On the Central Line, with 1962 tube stock, 33 per cent of defects were in door equipment and 45 per cent in electrical and electronic equipment.

8.26. The incidence of defects and failures is not directly related to the age, and hence condition, of each line's fleet. As can be seen from Tables 8.2 and 8.3, the newest rolling stock on the Jubilee Line has experienced some of the worst problems. In the past, insufficient attention has been devoted to analysing the causes of failures and defects in order to identify any changes in maintenance procedures that might be

required. The resources of the RSE and of the PSG have been mainly devoted to resolving safety-related issues.

Efficiency of depot operations

8.27. We were assisted in our study of rolling stock maintenance by consultants who, among other things, examined the efficiency of depot operations. A detailed study was undertaken at the two Central Line depots, Ruislip and Hainault, and the results supplemented by data relating to other LUL depots. Activity sampling studies of planned maintenance activities at these two depots indicated that productive time as a percentage of time booked varied according to the activity.

TABLE 8.5 **Productive time as percentage of booked time at Hainault and Ruislip depots**

Planned activity	*Productive time, average percentage*
12/14-day examinations	64
Shed day	46
Programme lift	66
Heavy overhaul	74

Source: MMC study.

Note: Non-productive time other than an acceptable amount for personal breaks was mainly the result of early completion of agreed standard hours for the shift.

8.28. The depot maintenance workforce is controlled by a measured work incentive scheme introduced in the mid-1970s. Observations at the two depots indicated that the work values used were slack and that no validation studies had been undertaken on a routine basis. Hourly paid staff were only expected to complete planned standard hours, regardless of the actual time taken to complete tasks. With slack work values this resulted in unutilised time at the end of shifts.

8.29. Up to 25 per cent of supervisors' time could be spent on bonus scheme administration, but our observations indicated that bonus payments did not reflect true performance. The administration appeared to be institutionalised so that actual labour-hour returns were always completed to give maximum bonus performance or better. Our consultants reported that the predominant task of supervisors was clerical or administrative, with minimal technical guidance or supervision of the maintenance activity.

8.30. A separate study by consultants employed by LUL during mid-1990, covering depots on the Bakerloo and Northern Lines, produced similar findings in relation to the incentive scheme and supervision. Both studies indicated a need for depot management and supervisors to take the initiative in managing the depot and workforce, rather than allowing the incentive scheme to do it for them.

8.31. Our consultants observed that the workforce at the Central Line depots were generally well skilled and experienced for their tasks. There were, however, a number of demarcations within the workforce, who were grouped by workshop staff (skilled and semi-skilled), train maintenance/ examiners (semi-skilled) and cleaners (unskilled). These demarcations tended to limit flexibility. LUL's consultants commented on inadequate training for `mechanic' level staff at the Northern Line depots.

8.32. LUL is concerned about maintenance standards at depots and the training of the workforce. In a paper to an internal LUL committee dated January 1991 the RSE described the state of LUL's rolling stock as at best mediocre. He attributed this to low standards of maintenance at depots among other things, due in part to lack of instructional material, inadequate training and poor management systems. He also stated that maintenance requirements were poorly specified.

Depot capacity

8.33. Planned maintenance work is undertaken on a day-work only basis in all depots. Night-work is confined to cleaning, nightly testing, 12- to 14-daily inspections and some minimal casualty repair work within the competence of the staff on duty. Our observations showed that the depot capacity utilised for all planned activities when the depot was manned was about 80 per cent. This ranged from 71 per cent for 12-/14-day examinations to 100 per cent for programme lifts and heavy overhauls. However, the present level of utilisation is less than 20 per cent assuming continuous availability of the facilities.

8.34. Under the present arrangements the maximum number of trains is available for maintenance at night, when the minimum depot labour capacity is available, ie train technicians (semi-skilled) and train cleaners. The introduction of night and weekend working could lead to a reduction in fleet size through a reduced spares margin, and possibly to fewer depots. LUL told us that it was examining ways in which some maintenance might be carried out at night and weekends. However, these would need to be cost-effective in the light of enhanced payments to staff for working unsocial hours. LUL also commented that recruiting staff with suitable skills would be difficult for night-work, and ensuring proper supervision was also a problem. In the case of casualty work LUL accepted that there was a need to strengthen the skills available at night in order to improve train availability performance.

Planned maintenance intervals and turnround times

8.35. The scheduled maintenance intervals for LUL rolling stock are shown in Appendix 8.3. Our study revealed that the actual intervals between activities varied significantly from plan for most if not all lines. An analysis of the maintenance records for a sample of Central Line rolling stock was undertaken and the results are summarised in Table 8.6.

TABLE 8.6 **Maintenance interval performance against plan (Central Line sample)**

Activity	*Maintenance interval percentage of sample*		
	Before target	*On target*	*After target*
12-/14-day examinations	26	14	60
Shed day	52	18	30
Programme lift	12	8	80
Heavy overhaul	60	20	20

Source: MMC study.

8.36. As can be seen, only 20 per cent at most of the activities took place at the planned interval. Most examinations and programme lifts took place later than planned while shed days and overhauls were earlier. LUL told us that the planned intervals are indicative and not critical to safety or reliability. The timing of much of the programme lift is inspection-driven and involves, among other things, changing wheels. If inspection reveals that wear on wheels has not reached a point requiring change, the lift will be delayed. Conversely, if wheel wear has reached a point requiring change, the unit will be held in the depot for lifting.

8.37. Our study also indicated that turnround times for some planned maintenance work were significantly longer than planned, in some cases up to two or three times longer. Analysis of a sample of Central Line rolling stock revealed that 80 per cent of programme lifts and 100 per cent of overhauls took longer than planned.

8.38. Turnround times exceeded the target for a number of reasons, including extended working time, early withdrawal of trains to ensure their availability for maintenance and casualty failures withheld from service to await a planned activity. LUL told us that this was an aspect it was looking at as part of its current value analysis review.

Depot Engineering Support Unit (DESU)

8.39. Part of the Engineering Operations Directorate, DESU is a specialised unit providing resources above and beyond those available at line depots. It operates two separate activities: a Train Modification Unit (TMU) at Acton for programmed major modifications to rolling stock and depot plant, and a Vehicle Repair depot at Ealing Common for the repair of collision damage to rolling stock and the maintenance of depot plant.

8.40. During the long life of rolling stock, over 30 years, changes in technology and operating requirements, including safety standards, result in the need to introduce modifications. The level of modifications required of LUL rolling stock over the last few years has been influenced by conversion to OPO and by changes in safety requirements following the King's Cross fire.

8.41. Major modification work is undertaken by TMU, where the work is organised on a production line or flow-type system. All materials are purchased in advance of a particular modification programme and held in a dedicated store. Vehicles are then `kitted' with components at the start of the production line so as to minimise or eliminate subsequent delays.

8.42. Some modifications are carried out in line depots by TMU mobile squads, while others are carried out by depot staff during routine maintenance work. A small proportion of modifications work is carried out by external contractors either on or off LUL premises. For the major programme of train refurbishment, consideration had been given to placing the work internally, but in the event contracts were placed externally as a result of competitive tendering.

8.43. LUL has revised its approach to initiating, vetting and planning rolling stock modifications in the last year, giving priority to the management of safety or safety-related modifications. The new procedure provides for publishing periodic reports on outstanding modifications. An analysis of the report for December 1990 indicated that 190 different modifications were outstanding, of which 46 per cent were categorised as safety-critical. The workload completed in the period covered was 179 units, with 26,020 outstanding. Assuming no additional modifications were added our consultants estimated that the current programme would take three to five years to complete. LUL considered this to be acceptable as the majority of modifications were planned to be carried out at programmed overhaul dates.

8.44. Examination of the records for individual modifications revealed that many had been outstanding for several years and that rates of progress had been slow. Examples included modification to the deadman handle, started ten years ago and only 50 per cent complete; modification to fire extinguishers, dated September 1986 and not yet started; and modification to compressor delivery hoses, started in October 1985 and only 40 per cent complete. All of these are classed as safety-related. LUL told us, however, that it considered that there were no modifications outstanding which would render rolling stock unsafe for passenger operation.

8.45. Responsibility for embodying minor modifications, including the supply of material and the planning of labour resources, now rests with the line businesses, specifically the Fleet Manager. These modifications will be undertaken by depot staff as the opportunity arises in the course of planned maintenance activity. Major modifications may be undertaken by TMU, although the future of this unit is in some doubt in view of future work volumes; the location it currently occupies is scheduled for redevelopment.

8.46. LUL told us that it was now adopting a project management approach to clearing the backlog of modifications work, particularly that which was safety-related. However, progress was constrained by the need to have trains available for service. LUL also told us that work needed to be done on classifying modifications in terms of priority. Furthermore the state of the records on modifications work done was not satisfactory and each line was now conducting a complete census of the state of each train in respect of such work.

8.47. The Vehicle Repair function of DESU is based at purpose-built facilities opened in 1989. LUL's policy for all but minor collision damage repairs is to seek competitive tenders. However, this distinction is

not clear-cut, with the average cost of repairs put out to competitive tender being £38,000 and the average cost of work kept in-house £33,000. Some 62 per cent of expenditure is subject to competitive tender.

8.48. Collision damage repair work is a long process, actual repair time averaging 34.5 weeks. To this must be added time for the estimating and tendering, plus time awaiting repair. Actual repair time alone represents an average of 1.25 trains continuously out of service across the network.

8.49. The depot plant repair function operates as an internal contractor maintaining depot fixed plant and equipment. Four teams of eight craftsmen each are employed and carry out the more specialised repairs to items such as lifting equipment, train-washing machines and roller-shutter doors. The teams also undertake minor installation and modification work to depot buildings and services.

8.50. While fixed prices may be quoted for work, for most of it there is no effective competitive tendering. Where contracts exist they are not all-embracing and work arising is charged on a labour and materials basis. All the services provided by the depot plant repair teams could be provided by either depot staff or external contractors.

Engineering management

8.51. As noted in paragraph 8.9, the RSE has professional responsibility for the condition of LUL's rolling stock. This includes the specification of new rolling stock and supporting equipment and of services in terms of overall performance, in particular availability, reliability and maintainability. It also includes the definition of maintenance and repair policy and the requirements for updating and modifying existing rolling stock. The rolling stock department of the PSG is also concerned with these matters.

8.52. In the past, LUL, in common with similar organisations, acted as its own prime contractor in obtaining new rolling stock. It took responsibility for the main aspects of vehicle design and the procurement of major components supplied to the chosen vehicle builder. Performance requirements in terms of availability, reliability and maintainability were set out in a formal way as part of the specification but did not form part of the contractual conditions for the supply of the rolling stock. Thus LUL took full responsibility for the performance achieved by the new stock.

8.53. For procurement of the prototype Central Line trains in 1983, and of the second batch of 1983 tube stock in 1985, LUL moved towards the external prime contractor arrangement. For the new Central Line stock LUL has extended this practice and appointed British Rail Engineering Ltd as the prime contractor for supplying the stock to a comprehensive performance specification. In addition to defining the operational performance to be achieved, including safety, availability and reliability, the specification also defines the processes to be followed to ensure that development and production activities are directed towards their achievement. LUL is satisfied, following an investigation of safety, availability and reliability specification used by other networks around the world, that the specification for the new Central Line rolling stock matches current best practice.

8.54. The RSE is responsible for the development and modification of maintenance policy, which is put into practice by the Fleet Managers of each line business. Maintenance instructions are issued by the RSE and Fleet Managers apply their own procedures based on the instructions. As noted in paragraph 8.32, the RSE is not satisfied with the present instructions. Some work has been done on the preparation of new manuals and supporting training material. The initial budget for 1991/92 limited the funding available for this work. However, a subsequent review has increased available funds to the minimum level considered necessary for the RSE to progress this work.

8.55. The maintenance and repair standards set by the RSE provide a minimum requirement to be achieved by the depots and are mainly directed to ensure the safe and reliable operation of rolling stock. Responsibility for the availability and reliability of rolling stock in service rests with the Fleet Managers.

Materials management

8.56. The materials management function in relation to rolling stock currently has 80 staff and the 1990/91 operating budget was £3.3 million. Purchasing expenditure for the year was budgeted to be £20.9 million, of which £6.0 million was for direct purchases to depot stores and £14.9 million for component repairs. In December 1990 the value of stocks held in depot stores was £6.5 million, of which £3.6 million represented maintenance-consumable items and £2.5 million represented repairable components. Analysis of issues data indicated stockturn rates of 2.2 for consumables and 6.5 for repairables.

8.57. LUL is now devolving responsibility for materials management, including depot stores, to the line businesses and has appointed eight line materials managers. It is intended to complete this process by July 1991.

8.58. The overhaul and repair of components removed from rolling stock during planned maintenance work is undertaken separately from rolling stock maintenance. Each line business owns spare sets of repairable components, such as compressors, traction motors and wheelsets, and operates a repair by exchange system so that trains do not have to be withheld from service awaiting component repair.

8.59. Most component repair work is undertaken at EOW. A small amount of work goes to external contractors. In accordance with DTp requirements LUL is pursuing competitive tendering for all relevant EOW activities over a five-year period commenced in 1990. EOW operates as a profit centre and has a formal customer/supplier relationship with the line businesses. Annual contracts are placed by line businesses, the terms of which provide for fall-back payments should the quantities submitted for repair by depots be outside the forecast limits.

8.60. LUL stated that the turnround times for components repair at EOW were within the agreed targets. However, our analysis of delivery performance from EOW showed that this was not always the case. For a sample of three major components (wheelsets, compressors and traction motors) control information from EOW indicated that between 30 and 58 per cent were not dispatched on target. LUL told us that hitherto control of repairable components moving through EOW had been exercised centrally. It believed that the transfer of control responsibility to the line businesses would lead to tighter control.

Permanent way

8.61. Collectively the track and associated features up to and including the boundary line fences are referred to as the permanent way. This term does not, however, include bridges over or under the track, viaducts, tunnels, embankments, cuttings or other structures. The LUL system covers 254 route miles with 680 miles of track open to traffic (see paragraph 8.2).

8.62. The track, consisting of running rails and two conductor rails, is supported in the open and sub-surface sections by softwood or concrete sleepers set in limestone or granite ballast. Point and crossing work is supported by either hardwood or softwood sleepers, while in the tunnels hardwood sleepers concreted into the tunnel inverts are generally used.

8.63. The running rails are either bullhead or flat-bottomed rails, secured to the sleepers with rail chairs or base plates. To a considerable extent LUL now uses 91.44 metre lengths of long welded rail, tight-jointed up to 730 metres in length and provided with adjustment switches. Two types of conductor rails are used, flat-bottomed in open sections and square sections in tunnels, mounted on porcelain insulators secured to the sleepers.

8.64. Since November 1986 maintenance of the permanent way has been managed on a client/contractor basis with the Permanent Way Engineer as the client and the Permanent Way Manager as the internal contractor.

Permanent Way Engineer

8.65. As the client, the Permanent Way Engineer is responsible for defining and applying the engineering and quality standards to which the permanent way is to be installed and maintained. He is also responsible for identifying, specifying and generally programming the necessary works for maintenance and renewal, and for securing the safe, reliable, cost-effective and timely execution of such works to the engineering and quality standards adopted. He has a total establishment of 174 staff, including 57 management, 60 technical and 47 inspectorate staff.

Permanent Way Manager

8.66. With overall responsibility for managing the internal contractor workforce, the Permanent Way Manager is responsible for resource planning, detailed planning and the timely, efficient and cost-effective execution of works as identified and specified by the Permanent Way Engineer. Where necessary, and with the agreement of the Engineer, he can adjust the programme of work.

8.67. The purchase, storage, distribution and utilisation of materials to be used in specified works are also the responsibility of the Permanent Way Manager, as are the recovery of used materials and the return of reclaimed and surplus materials to stores for rebate and credit. The Permanent Way Manager is also responsible for managing and operating permanent way depot facilities and any appropriate subsidiary services created. His total workforce establishment for 1990/91 was 1,665.

Permanent way inspection

8.68. The state of the permanent way is monitored by a system of planned inspections. Safety inspections are carried out by patrolmen, under the control of the Permanent Way Manager, daily for strategic points and crossings, every two days for all running lines and every three days for depots and sidings. The purpose of these inspections is to detect any condition which is actually or potentially unsafe or likely to cause a delay in service. In the course of their rounds patrolmen carry out minor repairs, such as bolt tightening.

8.69. Every eight weeks the main running lines are inspected by permanent way inspectors controlled by the Permanent Way Engineer. Depots, ditches, drains, embankments and fences are inspected every 12 to 26 weeks as appropriate. The LUL system is divided into 19 areas, with an inspector responsible for each area. He checks for work that needs to be done and for work already identified but not yet done, to ensure that it has not become urgent. The inspector also checks work in progress and work that has been notified as completed.

8.70. The inspectors carry out separate annual inspections of short rails and twice-yearly inspections of long welded rails, specifically to address the problems of heat expansion of the track in hot weather and the consequential risk of rails buckling. General inspections are carried out at regular intervals to assess track quality in relation to laid-down standards, while ultrasonic rail flaw detection is carried out twice a year on all running lines. At present this work is done manually using hand probes, with special attention being given to rail ends at joints.

8.71. LUL also has a track recording vehicle which is operated over all running lines approximately eight times a year. This provides data on the geometric condition of the track, through computer print-outs.

Permanent way maintenance

8.72. Some maintenance work is undertaken at defined intervals, the frequency varying according to the activity and the site concerned. This work is undertaken by the Permanent Way Manager's staff and includes such tasks as cleaning and filling rail lubricators, cleaning and oiling points, track litter-picking and tunnel cleaning.

8.73. Other maintenance work arises on a random basis from inspectors' reports and includes such tasks as spot resleepering, fettling (generally tightening track components) and the renewal of fish-plates. Standard tasks are priced on a time and materials basis.

8.74. The client engineer maintains a work bank and releases work to the contractor with defined priorities and response times. A standard computer-based management system, Direct Labour Organisation Management System (DLOMS), is used to control the work ordering and charging process.

8.75. Tamping of the track to compact the ballast supporting the sleeper is carried out by tamping machines owned and operated by LUL. The workplan provides for all tampable track (the open sections) to be tamped on average once every 15 months. This has not been achieved for various reasons, including problems with the reliability of the tamping machines. In an attempt to restore the position on the Metropolitan Line LUL employed a privately-owned tamping machine on contract, but this was suspended when an accident at Chorleywood resulted in the death of four people. More recently LUL has proposed increasing the use of its existing three machines from five to six nights a week.

8.76. On the open sections maintenance also involves vegetation control, including weed killing, undergrowth containment and tree pruning. This work is undertaken on a continuous basis, particularly in the summer months. Equipment used includes a special train equipped for dispensing weedkiller which makes one trip round the whole system every spring. For environmental reasons station areas, depots and sidings are dealt with by hand spraying. LUL also has a leaf clearing machine used in the autumn at the northern end of the Metropolitan Line.

8.77. As part of the programme to improve safety standards LUL has a three-year programme of heavy cleaning, up to about knee height, of the track and its environs in tube tunnels. The aim is to reduce airborne dust levels and the risk of fire. LUL has also developed a tunnel-cleaning train, which will re-enter service in mid-1991 following a major overhaul. This train will be used five nights a week to maintain and augment the standards achieved by heavy cleaning.

Renewals

8.78. The need for renewals is identified in the first instance by the permanent way inspectors and is subject to confirmation by more senior staff. Renewals work includes:

- relaying a section of track;
- resleepering a section of track;
- retimbering under points;
- renewal of conductor rails;
- relaying major junctions;
- reconditioning in tube tunnels; and
- rerailing.

Once approved, renewal items are given a priority and placed in a programme which takes account of strategic long-term needs. Because of the frequent need for design work and of the material lead times this programme is normally developed two or three years ahead of the work actually being done. Work included in the following year's budget is selected by October each year. LUL also has a 25-year programme for switching over from bullhead rail and timber sleepers to flat-bottomed rail and concrete sleepers on the open sections.

Emergency work

8.79. Emergency squads of four to six men are based at Lillie Bridge depot and Baker Street station. These squads respond to emergency call-outs on any part of the system. LUL told us that it was not practicable to provide routine day-work for the Baker Street squad, but the squad at Lillie Bridge was given work consistent with the prospect of being called out at any time.

8.80. Adverse weather is catered for using, in particular, the vegetation control group. Maintenance gangs are also used in very severe weather.

Current issues

8.81. LUL told us that the main issue which dominates the attention of the Permanent Way Engineer is to reverse the decline in track quality standards and effect improvements. Track geometry, as monitored by the track recording vehicle (see paragraph 8.71), is considered by the Permanent Way Engineer to be substantially worse than on other equivalent railways as regards misalignment and undulations. This gives rise to poor ride quality and environmental performance in terms of noise, and to excessive wear and strain on rolling stock and track components. Currently the track recording vehicle is showing about 50 per cent of the track as satisfactory and a further 25 per cent as adequate. As an example of the problem LUL told us that the stress tolerances designed into the bogies for the new Central Line stock allowed a margin above those imposed by the current condition of the track. The rate of deterioration of the track was such that by the time the new stock entered service, stresses would be at or near the design tolerances.

8.82. A number of factors have combined to produce the present situation. The condition of the track is poor owing to the breaking down and fouling of the ballast: LUL made extensive use of limestone in the past. Unlike BR, which has been able to clean ballast at 15-year intervals, cleaning and renewal of ballast in LUL has not taken place, partly for cost reasons but also because of difficulty in gaining adequate access to the track. Although the ballast is in poor condition, however, LUL considers that the condition of other track components is as good as on equivalent BR lines.

8.83. Track technology, particularly in respect of bullhead rail and timber sleepers (see paragraph 8.78), is frequently outdated. LUL told us that this resulted in a reduced standard of overall track performance compared with that obtainable from modern track forms and methods. It also requires high levels of maintenance and thus increases costs.

8.84. Maintenance practices are very constrained and often out of date. As an example, tube track reconditioning is carried out within extremely limited possession times, normally about four hours on weekday nights, and in a very labour-intensive manner. Much work is undertaken using hand tools such as crowbars, hammers and shovels in very bad light. Compressed air tools are used on reconditioning sites, with air-lines running from a compressor mounted on an adjacent station platform. Internal combustion engines cannot be used in tube tunnels for safety reasons, particularly because of exhaust fumes, although special equipment is being developed to allow limited use of small diesel engines. LUL told us that initiatives to carry out tube track reconditioning work using a larger proportion of power tools had not so far been successful and were currently limited by cash constraints.

8.85. Apart from problems with the reliability of tamping machines, LUL said that permanent way plant and equipment, such as ballast handling equipment and stoneblowers, is often insufficient for the work required. Further equipment is now being sought as part of the plan to upgrade the track over a 15-year period. The current Engineers' train fleets are shown at Appendix 8.6.

8.86. The forecast out-turn for maintenance and renewals expenditure on permanent way work in 1990/91 was £63.2 million, a reduction of £6.5 million on the original budget. The total includes £21.5 million of capital expenditure, mainly on renewals and plant. For 1991/92 the initial bid was for £81.7 million, including £36.1 million of capital expenditure, which assumed a ten-year programme for upgrading the track. The approved budget is only £56 million, including £15 million of capital expenditure, based on a 15-year programme and reductions or deferment of some permanent way-related projects.

8.87. In evidence to an internal committee on the safety implications of spending limits in 1991/92 the Permanent Way Engineer said that track quality would certainly decline. However, safety could be maintained by targeting resources and by controlling traffic speeds. Effective monitoring and control were essential and would be provided by increased patrolling, increased use of the track recording vehicle and increased condition monitoring by supervisory and technical staff. Improved work planning was also necessary to ensure priority for safety-critical maintenance.

8.88. Apart from the prioritising work, safety would be ensured by the use of speed restrictions or, in extreme cases, by withdrawal of service. Traffic speeds on LUL are generally determined by the signalling system. Some sections are subject to permanent speed restrictions because of the configuration of the track, for example points and crossings or parts of the tube system with sharp curves and extra narrow tunnels. Temporary speed restrictions are imposed to meet particular circumstances and are either planned, as part of the work programme, or emergency, because of problems identified by the inspection process.

8.89. Temporary speed restrictions normally relate only to sections of track. However, the Metropolitan Line currently has an overall speed restriction of 50 mph, imposed in October 1989 because of the condition of the track, while the Piccadilly Line has an overall speed restriction of 45 mph, imposed in December 1990 because of the current problem with motor brackets on the rolling stock. Over the last three years the ratio of actual temporary speed restrictions to those programmed has been about 2:1. In 1989/90 emergency speed restrictions were imposed on 154 occasions, while in the first 11 periods of 1990/91 there have been 103 such occasions.

Future developments

8.90. Three special teams have been created by the Permanent Way Engineer, covering track quality, business management and cleaning and vegetation control. Their role is to identify and develop implementable plans which will improve the performance and cost-effectiveness of the permanent way in the shortest possible time. In addition development work is being undertaken in a number of areas, including both new research and adapting the work of others to the LUL environment. Apart from technical developments in rail forms, maintenance techniques and equipment this work includes the development, in conjunction with BR, of a computer-based asset data register and resources planning system known as MARPAS.

8.91. LUL has set up two working parties to examine the problems associated with providing increased access times to the permanent way for engineering work. One is examining the service, cost and revenue implications of altering the length of the traffic day by later starts and earlier finishes. The other is considering the cost, resource and other implications of increased engineering access time.

8.92. The LUL Board approved proposals to devolve responsibility for day-to-day and routine maintenance of the permanent way to the line businesses by April 1992. Apart from some strengthening of engineering management in the line businesses the changes were not expected to lead to any increase in manpower. They involved the transfer to the line businesses of 41 staff from the Permanent Way Engineer and 894 staff from the Permanent Way Manager. Some capital expenditure would be required for accommodation. The value analysis review team for permanent way is examining the details as part of its overall review of this area.

Signalling and control systems

8.93. The signalling and control systems currently used by LUL include a wide range of technologies spanning some 50 years. The oldest signalling installations are controlled from signal boxes located along the length of the line. Points and signals are controlled either by separate levers or by one lever or push button per route. The areas controlled by such boxes range from a single station, for example Liverpool Street or Marble Arch on the Central Line, to several miles of route, as in the case of the Rickmansworth box on the Metropolitan Line.

8.94. Over the last 25 years LUL has been progressively replacing these installations by automatic systems supervised remotely from a centralised control centre. At present there are three such centres covering all lines other than the Central, Circle and Hammersmith and East London Lines. The sophistication of the technology in use in such centres varies widely. Earlier systems used a programme machine with a punched roll timetable to set routes automatically. More recent systems use computer technology which allows a more sophisticated man/machine interface and additional control facilities.

8.95. When opened in 1969 the Victoria Line introduced a system of ATO coupled with a programme machine technology for automatic route setting. In this system lineside signals are not normally provided except at junctions, for starting at stations and for manual driving in an emergency.

8.96. The operation of trains is controlled by the signalling system, using blocks, or sections of track, monitored by track circuits. Only one train at a time can enter a block. The LUL system has over 8,000 track circuits. On all lines except the Victoria Line train protection relies on signals which automatically turn red as a train enters a block, together with train stops which raise a trackside arm in order to apply the brakes of any following train attempting to pass the red signal. The train stop clears as the first train moves to the next block. LUL has 3,440 train stops.

8.97. Train speeds are to a large extent regulated by the train driver (except on the Victoria Line), particularly on those sections subject to permanent speed restrictions. On most lines the signalling system is a significant factor determining line capacity, that is the maximum frequency at which trains can be operated. Other factors include the flexibility of track layout, the operation of junctions (a particular problem on the Northern Line) and the effect of station-stop times. Much of LUL's signalling system was designed for a train service density that is now inadequate following the increase in passenger demand. Some 60 per cent of the signalling equipment is over 20 years old. Most installations incorporated some margin for increased service density, but in many cases that margin has been absorbed.

8.98. The traditional fixed-block signalling systems, based on track circuits, combined with manual driving of trains will result in a limit on service density, particularly when other factors such as variations in driving techniques and physical line constraints are taken into account. Some improvement is secured by using an automatic train control (ATC) system rather than a manually driven system. For example, the resignalling on the Central Line will use an ATC system which, with other factors, will permit an increase in scheduled service density from 30 to 33 trains per hour.

8.99. In the longer term LUL is examining the potential for introducing moving-block systems. The principle of such systems is that a safe distance is continuously maintained between any two trains such that the second train can always be brought to a halt before any impact. Moving-block signalling is most easily provided using a transmission-based signalling system with two-way communication between train-carried equipment and a trackside computer. The system does not require continuous detection of trains by track circuits. Significant improvements in service density are possible with such systems. However, such systems cannot be readily applied to LUL lines without some further development.

Passenger information systems

8.100. The traditional way of disseminating train information to passengers waiting at stations has been by means of illuminated panels known as train describers. These are switched from local signal boxes or programme machines and usually only indicate the destination of the next train; they do not show arrival intervals. LUL is replacing train describers with dot matrix indicators which show the destination and waiting time for, typically, the next three trains. Some 300 dot matrix indicators have been installed so far. The simplest dot matrix system relies on the passage of a train over a track circuit to enable the destination to be displayed and arrival time to be calculated. More complex systems now installed on some lines, driven by central computers which control the signalling systems, are more accurate and reliable. Additional messages can also be displayed on these indicators.

8.101. Where a computer control system is installed there is an alternative means of passing information to customers by closed circuit television (CCTV) screens and these are being used on a trial basis at some locations. In addition all stations are now covered by one or more public address systems. LUL now has public address installed at 783 sites, often in zones at individual stations in order to give specific information. Centralised control of public address is provided for each line.

Maintenance and renewal

8.102. The maintenance of the signalling system is managed on a client/contractor basis in much the same way as that described for the permanent way. The Signal and Control Systems Engineer (the client) is responsible for:

(a) setting safety, quality and technical standards and establishing their achievement by auditing and surveillance;

(b) providing stewardship of assets by ensuring that systems are maintained in a safe and reliable condition and are renewed at appropriate intervals; and

(c) providing LUL with a focal point for the exploitation of technical advances in terms of safety, reliability and business performance.

8.103. In relation to signalling systems the General Manager (Signal and Electrical Contractors) is responsible for:

(a) the conversion of the Engineer's general programme of maintenance and renewal into a detailed resource and equipment schedule by which the quality and cost objectives specified by the Engineer can be achieved;

(b) the conduct of works so generated in a safe, cost-effective and efficient way; and

(c) the management and control of materials and spare parts.

He has a total workforce of nearly 1,700, most of whom are engaged on signalling maintenance work. He also has responsibilities for lighting, cables, ticket machines and gates and communications equipment.

8.104. At present most signalling maintenance work is undertaken by the internal contractor on terms agreed under the LUL Intra-Company Trading Agreement. LUL intends to devolve day-to-day and routine maintenance of signalling systems to the line businesses. This will involve the transfer of 535 staff from the internal contractor plus three from the Signal and Control Systems Engineer.

8.105. LUL has historically carried out its own installation work, but a proportion is now subject to competitive tendering. A recent major change has occurred on the Central Line Project, where the signalling installation work has been placed with the equipment supplier, who has been given main contractor responsibility for the detailed design, supply and installation.

8.106. LUL's signalling system is broadly divided into vital and non-vital equipment. The vital signalling equipment is fundamental to safe train movement and has a direct effect on the density of trains at each point. Non-vital equipment complements the vital equipment with respect to train density and also provides overall control of a line. It makes a major contribution to the efficient and effective operation of a line and has provided economies, particularly through increased automation.

8.107. The maintenance of vital signalling is based on a programme of inspection and regular maintenance and testing. The principal inspection programme involves a 12-week schedule whereby signal technicians (employed by the internal contractor) walk the track and physically inspect, and in many cases test, every piece of equipment. Daily use of the system and the consequent reports, originating from train staff, to control centres regarding actual or possible malfunctions provide an effective short-term inspection of safety and functioning.

8.108. LUL operates a comprehensive range of certification procedures whereby all track circuits are tested annually. A programme is being introduced for testing every five years both the integrity of each system with its interlocking features and all signalling safety cabling insulation. The Signal and Control Systems Engineer and his senior managers, together with staff from PSG, carry out spot and random checks throughout the system. Independent of all these inspections, the Safety Engineer carries out a

specific audit of the quality and integrity of maintenance procedures to ensure that safety and quality targets are met.

8.109. For regular maintenance and testing all assets have been grouped into six-weekly, 12-weekly and annual maintenance cycles according to the nature of the equipment concerned. The six-weekly maintenance groups cover equipment with mechanical movement which is not permanently sealed, such as trainstops, points (motors) and disc signals, and the work involves lubrication and checking for correct operation. Sealed equipment with mechanical movement and non-mechanical equipment, such as colour-light signals, route indicators and relays, fall in the 12-weekly group. Here the work involves visual inspection, cleaning and checks for correct operation, with adjustment as necessary. More specialised maintenance on equipment such as interlocking machines, track circuits and points heaters takes place annually. This work is carried out either by specialist groups or by individual technicians responsible for a particular area.

8.110. The routine changing of signalling equipment is undertaken at defined intervals ranging from seven to 14 years depending on the equipment type. The equipment removed is returned to the signal overhaul shop (part of the internal contractor organisation), where it is stripped down and rebuilt with reconditioned components before being stored for eventual reuse. Equipment that does not have mechanical movement (mainly electronic-based, mostly on the Victoria Line) is not changed routinely. However, maintenance procedures provide for the regular performance monitoring of such equipment.

8.111. When equipment fails in service it is either repaired on site or replaced. In many cases, when a failure occurs during traffic hours and the priority is to keep the service operating, a temporary repair is effected where possible, the equipment being replaced during engineering hours. The defective equipment is then returned to the signal overhaul shop for examination, repair and subsequent reuse.

8.112. The nature and extent of regular maintenance on non-vital equipment depends on the technology employed. There is not much equipment in this category with mechanical movement and little regular maintenance is necessary. Similarly equipment based on 1960s and 1970s electronic technology does not normally require regular maintenance. Computer hardware, however, requires regular maintenance, usually on parts with mechanical movement, such as fans and disc drives. Such work is undertaken by specially trained LUL staff, with a back-up service provided by external contractors.

8.113. When a hardware failure occurs in non-vital equipment the failed item is normally replaced as soon as possible. Non-vital systems incorporate various amounts of diversity and redundancy which permit train movement to continue, often with little delay, pending replacement. Software failures, however, can bring the train service to a halt, even where redundancy exists, because the software is common to all systems. The maintenance staff do not normally possess the specialist skills necessary for the investigation of such failures. To restore train services the computer or micro-processor system can be reinitialised, but this can result in loss of information on the software failure. In this case there is close co-operation between the maintenance staff and software specialists to restore the train service as soon as possible while retaining information.

Future developments

8.114. The main developments in the next three to four years are the resignalling of the Central Line and the devolution of day-to-day and routine maintenance to the line businesses (see paragraphs 8.98 and 8.104). Work on the Central Line is being undertaken by external contractors and is proceeding unaffected by the present financial situation. The devolution of maintenance work for signals and electrical will be reviewed in detail by the signals value analysis team as part of its overall work in this area.

8.115. Because of the financial situation LUL has made some modest reductions in the maintenance budget for 1991/92, now set at £24.8 million. These have been achieved with the aim of minimising the risk to safety by extending the routine change cycle of some equipment, reducing weekend cover and overtime and partly by reducing inspections and overhaul work. However, the initial bid for the capital expenditure budget has been reduced by some 50 per cent, largely through the deferment of development and betterment projects, including transmission-based signalling for the Northern Line. All essential safety

work, including that arising from the Fennell and Hidden Reports, is continuing and has been budgeted for in 1991/92.

Lifts and escalators

8.116. As noted in paragraph 8.5, LUL has a total stock of 70 lifts and 274 escalators serving 26 and 69 stations respectively. Oxford Circus, with 14, is the station having the largest number of escalators. In common with other engineering maintenance work on LUL, most lift and escalator work must be done at night, ie about 65 per cent of maintenance and repair work and 75 per cent of cleaning. The physical constraints of most deep stations are such that it is not possible to work on an escalator while adjacent escalators are operating.

Maintenance and renewal

8.117. The overall maintenance and major overhaul of lifts and escalators have been managed on a client/contractor basis since April 1987. The Lift and Escalator Engineer (the client) is responsible for:

(a) defining and applying the engineering, safety and quality standards to which lifts and escalators are to be installed, operated and maintained;

(b) securing the safe, reliable, cost-effective and timely execution of work, to the engineering and quality standards adopted, through internal and external contractors; and

(c) inspecting works and auditing standards to ensure compliance with *(a)*.

The Lift and Escalator Engineer has a permanent staff of 64 (at November 1990) supplemented as necessary by seconded or temporary staff.

8.118. The internal contractor is the Lift and Escalator Manager, with a workforce of 536. He is responsible for:

(a) resource planning, detailed planning and safe, timely, efficient and cost-effective execution of lift and escalator works identified and specified by the Engineer. Increasingly, maintenance activities are being performed under a comprehensive performance contract; and

(b) purchase of materials for maintenance and major activities and storage and inventory control of materials for maintenance. Materials for major works are managed and held by the Engineer.

8.119. LUL also uses external contractors for installation and maintenance work. Until recently only one such contractor was used but there are now four. The internal contractor maintains 210 escalators, external contractors 55; the remaining nine are currently being replaced. For lifts the position is the reverse, with external contractors maintaining 45 and the internal contractor 20. Again, some are being replaced. Some 75 per cent of the materials used by external contractors for maintenance are purchased and stored by the internal contractor. No materials for new installations are held by the internal contractor.

8.120. Planned preventative maintenance on escalators is undertaken at specified intervals, with inspections and servicing to specified items taking place every one, five, ten or 50 weeks. This work is carried out by internal or external contractors under the competitive tendering arrangements, or in some cases by extended warranty arrangements following installation. In addition all escalators are visited daily by plant attendants (LUL or contractor staff) who empty dust trays and remove any fire hazards. This is now being changed to every two or three days as a result of a risk assessment study. Separate programmes of cleaning and lubrication are also carried out; the interval between cleaning is specified not to exceed six months.

8.121. Any necessary repairs identified in the course of preventative maintenance procedures involving major items, such as chains, steps, motors or handrails, are programmed and carried out by internal or external contractors. Statutory inspections of escalators are carried out by engineering surveyors under contract.

8.122. The planned preventative maintenance arrangements for lifts are similar to those for escalators, with inspection and servicing to specified items at five- and 20-week intervals. The cleaning of lift tops and shafts is carried out by LUL staff, while statutory inspections are again undertaken by engineering surveyors.

8.123. In February 1988 LUL submitted a paper to DTp detailing the strategy for escalator replacement. Among other things the paper indicated that the replacement rate for `M' series machines was under review following the King's Cross fire. It was decided that these escalators, characterised by wooden decking, balustrades, treads and risers, would have all wooden components removed by 1 January 1996 (see Appendix 2.2, paragraph 7). The average age of the escalator stock is about 30 years, with 65 machines over 45 years old.

8.124. LUL told us that the engineering condition of its escalator stock had declined to a point where a considerable backlog of maintenance work exists. In March 1989 the LUL Board approved a strategy to arrest this decline and restore the condition of escalators by a programme of major overhauls. This programme is defined as the key asset plan and will systematically review all machines to:

- understand their condition;

- develop plans to achieve reliability improvements;

- enhance specifications, improve materials planning and control, improve work planning and project management skills and progressively enhance maintenance and quality controls; and

- carry out work to restore asset health.

8.125. The first full year for the key asset plan, which is still being developed, was 1990/91 and £8.1 million was included in the budget. LUL told us that it had proposed a budget of £11.3 million for 1991/92 but, because of the financial situation, had reduced this to £4 million.

8.126. LUL's Business Goal 2 set a target to be achieved by April 1991 for no more than 35 escalators to be out of service at a time. Given that 25 are out of service as a matter of routine for overhaul or replacement, this target allows only ten unscheduled withdrawals. As a consequence of both the maintenance backlog and work arising following the King's Cross fire and subsequent Fennell Report, the number of escalators out of service reached a peak at nearly 100 in June 1989. In other words only 66 per cent of the escalators were available. Since then the position has steadily improved, with the Business Goal target reached on some days and the general level of availability running at 85 to 86 per cent. The Business Goal target is equivalent to 87.2 per cent availability. However, LUL told us that the financial constraints in 1991/92 would probably result in a decline in availability. There would certainly be a set-back to the recovery programme and a number of betterment and development projects would be deferred.

8.127. The Fennell Report recommended that LUL should replace escalators at the rate of at least six a year. LUL completed eight replacements in 1990/91 and had planned for 11 in 1991/92 but this was now reduced to two. The maintenance work had been reduced on those escalators scheduled for replacement, with the result that their engineering condition was below standard, giving rise to an increased risk of failure and potentially higher maintenance costs.

8.128. LUL told us that one aspect of the reduced expenditure in relation to the replacement of escalators that caused some concern was the possible effect on the availability of external contractors. Considerable effort had been devoted to increasing the external supplier base from one to four (see paragraph 8.119). LUL was concerned that, without a regular flow of work, at least some of the external suppliers would not have the skilled resources available when the financial position improved.

Structures

8.129. LUL owns a large number of structures, including bridges, tunnels, stations, depots, viaducts and retaining walls. Details are given at Appendix 8.7. These structures are of widely differing material and quality of construction, dating back as far as the 1860s in some cases. Cuttings, embankments and drainage also form part of the structures inventory.

8.130. The engineering specifications used when most of the structures were built did not envisage the present level of loadings or the hostile environment encountered today. Consequently LUL faces major challenges in maintaining the upkeep of its structural assets. LUL stated that structures were maintained in a basically safe condition, but years of underfunding had created a legacy of deterioration and implicit high future maintenance costs.

8.131. A survey of stations undertaken in 1980 indicated that nearly 50 per cent of the stations were in a `fair or poor' state of repair. A station modernisation programme valued at £60 million (1981 prices) was undertaken, based on 141 schemes. This included 17 heavily used central area stations, 32 suburban stations in a `poor' state and 92 less heavily used stations in a `good or fair' state.

Maintenance

8.132. The maintenance of structures is controlled by the Premises and Structures Engineer (PSE) on behalf of the Civil Engineer. His principal task is to maintain cost-effectively all structures in a manner which ensures safety and offers the customer an acceptable travelling environment. The PSE engages PSG to manage the detailed execution of the work programme, using external contractors to carry out the work.

8.133. Stations and depots are inspected annually, except when in the process of renovation or in the year immediately following such renovation. They are subject to more detailed appraisal every three to five years, depending on considerations of safety, traffic and projected residual life. All bridges are subject to a visual inspection annually to identify defects which give rise to risk, such as cracks, displaced masonry or signs of damage from vehicles or vandals. Detailed surveys of bridge structures are undertaken every four years. Cast-iron tunnel linings are inspected every 12 years and pre-cast concrete linings every four years.

8.134. Some 75 per cent of this inspection work is carried out by LUL staff and the remainder by approved consultants appointed on an annual contract. Specialised structures are inspected by approved specialist consulting engineers. The strength of bridges is assessed by consultants routinely on a ten-year cycle, or on occasions when a change in loading limits is proposed.

8.135. All works identified by the inspection process are subjected to a priority assessment. Essential safety work is always carried out immediately, independent of existing budgetary provision. Other works fall into one of three priority categories:

(a) Priority E-items which must be carried out within the financial year, including work which if delayed would have implicit financial penalties;

(b) Priority 1-items falling into E but which are unlikely to be funded until the following financial year; and

(c) Priority 2-all other identified works.

8.136. Once budgetary provision and approval is complete, all works are commissioned through a client brief prepared and issued by the PSE. This document forms the basis for the detailed work carried out by PSG to let the contract after competitive tendering and to control it to the point of completion. At this stage it is formally handed back to the PSE, who is responsible for approving the work done.

8.137. Buildings are maintained on a day-to-day basis on demand from the user, via an ordering service operated by PSG. The client briefs and specifications are again provided by the PSE. Heavy cleaning of ventilation shafts and under platforms is carried out under the control of the PSE by both internal and external contractors.

New construction and renewals

8.138. The construction of completely new facilities is managed by capital project teams established for specific extensions of the system, such as the Jubilee Line. Stations may be reconstructed as part of a commercial development activity, for example Mansion House station, or for operational reasons, such as Angel station. Structures other than stations are normally only renewed for safety reasons or where necessitated by developments such as road construction.

Recent developments

8.139. Because of the current financial situation much of the planned work on premises and structures has been stopped or deferred for one year. In the first seven periods of 1990/91 revenue expenditure had exceeded budget by 51 per cent. The overspend was attributed to work carried over from the previous year. A two-month moratorium was imposed on placing new contracts in order to recover the situation, giving a forecast year-end out-turn of £22 million compared with the original budget of £24.2 million. Capital expenditure for the year was reduced from £11 million to £8 million.

8.140. For 1991/92 the revenue budget has been set at £23 million, compared with an initial bid for £33 million, and the capital budget at £6 million against a bid of £61 million. The moratorium on placing new contracts is being maintained, but inspections are being continued at present levels and the provisions for emergency work retained.

8.141. The most pressing current problem relates to LUL's extensive pumping and drainage system (some 360 miles of track drainage). LUL told us that this system was suffering from years of neglect and that maintenance had been inadequate or non-existent in the past. The problem was being accentuated by the slowly rising water table in the London area. An additional £1.8 million revenue expenditure was incurred in 1990/91 in respect of work urgently required and work will continue in 1991/92. LUL predicts that this work will give rise to a funding requirement of £40 million up to 1995.

8.142. While drainage has been the responsibility of the Civil Engineer, responsibility for pumps has rested with the Lift and Escalator Engineer. From April 1991 responsibility for pumps is being transferred to the Civil Engineer to improve the co-ordination and planning of the necessary work.

8.143. Another problem facing LUL arises from the legislation permitting an increase in maximum axle-loads for road traffic to 38 tonnes. Because of this LUL will need to review the adequacy of its bridges and believes that a substantial number will require strengthening (see paragraph 8.130). LUL predicts that over the next ten years funding in the order of £100 million will be required.

8.144. Co-ordination of the bridge assessment programme will be undertaken by DTp. A London Bridge Co-ordinating Working Group has been established with representatives from DTp, the 33 London boroughs, the Metropolitan Police and LUL.

Ticketing equipment (UTS)

8.145. The engineering arrangements for dealing with ticketing equipment are similar to those described above, with a client/contractor relationship. The client engineer, with 34 staff, is responsible for specification and standards, for maintenance contract administration and for development work on both hardware and software systems. LUL has a systems support contract (software) with Westinghouse Cubic: maintenance of the ticket machines and gates is at present shared between the internal contactor (General Manager Signal and Electrical Contractors) (63 per cent) and external contractors. Revenue expenditure in 1990/91 was £10.2 million, some £1.6 million below budget. This was attributed by LUL to a lower than expected consumption of spares.

Power supply

8.146. LUL has a peak demand for electricity during a severe winter of about 230 MW. It generates about 70 per cent of its needs at two generating stations located at Lots Road and Greenwich. The balance is obtained from the National Grid via London Electricity Plc at a supply point at Neasden.

8.147. Statutory regulations for the operation of an underground railway require that two independent sources of electrical supply are available for lighting any part of the network that is underground. This ensures that an acceptable level of emergency lighting is available in the event of one supply source failing. LUL meets this requirement by generating power for the deep-level tube line to meet both traction power demand and 75 per cent of the lighting. London Electricity supplies are used for the remaining 25 per cent of lighting and both sources are available for lighting tunnels between stations.

8.148. Some non-tube tunnel parts of the LUL system obtain electricity supplies from the National Grid because the LUL generating capacity is not large enough to meet the peak requirements of the entire system. There is also a portion of the load that can be transferred between LUL generation and the National Grid. This normally amounts to about 10 MW of the total 230 MW peak demand.

8.149. The generating equipment in the Lots Road and Greenwich generating stations will become life-expired in the early 1990s. In January 1985 DTp approved a future power supplies project whereby all power would be purchased from the National Grid following the installation of new bulk supply points. The Lots Road and Greenwich generating stations were to be closed, thereby avoiding substantial capital expenditure and reducing staff numbers by about 140 posts.

8.150. Following the downturn in oil and gas prices in 1986 and 1987, LUL undertook a review of the self-generation option. A review team, assisted by consulting engineers and merchant bankers, concluded that the most beneficial option would be to replant Lots Road and Greenwich both to supply LUL and to sell surplus electricity. Scottish Power plc and Veba Kraftwerke Ruhr AG were selected as partners to form a new electricity generating company called MetroPower Ltd (MetroPower).

8.151. MetroPower's initial purpose is to develop a business plan for the re-equipping and future operation of Lots Road and Greenwich. Government and other regulatory consents and approvals will have to be obtained. LUL will be examining the external supply market and will seek tenders for its power needs. The MetroPower business plan proposals will be measured against the external market proposals.

8.152. The costs of each of the three shareholders in forming MetroPower will be capitalised. If the project is abandoned, all costs from 1 August 1990 will be pooled and paid in proportion to the parties' agreed initial share. LUL's share will be provided by transferring buildings and plant and by leasing land to MetroPower, subject to final agreement, for 25 years at a peppercorn rent. The original planned reduction of 140 posts in LUL will still be achieved.

8.153. Provision is made for monthly reviews of the project, with a major review by the MetroPower Board each quarter. If all parties agree that the project is not viable, provision is made for the business plans study to be discontinued.

8.154. In 1985 LUL formed an Energy Management Unit to identify usage and cost-saving opportunities. The continuing savings achieved are in excess of £1 million a year. Further energy- saving opportunities are being pursued.

Management of day-to-day operations

8.155. Our terms of reference (question 1*(e)*) require us to consider the extent to which any deficiency in the quality of service is the result of inefficiency. The factors involved in the day-to-day operation of train services are:

(a) rolling stock availability;

(b) train crew availability (two crew per train on Northern and Central Lines, one on all other lines);

(c) signalling and control systems;

(d) track condition; and

(e) power.

Failure in any of these factors can bring train services to a halt or lead to a reduced level of operation. However, *(a)* and *(b)* are the most common causes. In addition the need to call emergency services has become a key factor influencing performance.

8.156. Although not necessarily affecting overall service on a line, stations are an important aspect of service quality at local level. Key factors here are:

(a) staff availability (stations are closed for safety reasons if insufficient staff report for duty);

(b) lift and escalator availability;

(c) passenger information systems;

(d) ticket offices, machines and gates; and

(e) station environment, for example cleanliness.

8.157. Overall responsibility for service operation rests with the LGMs. However, actual day-to-day control of the train services rests with the Train Service Managers and their centurion and duty managers. They are directly responsible for train crew and signal and control staff, but are dependent on Fleet Managers for rolling stock availability. Engineering maintenance of track, signal and control systems and the provision of traction power are the responsibility of the central Engineering Directorates as described earlier in this chapter. However, as noted in paragraphs 8.92 and 8.114, day-to-day and routine maintenance of track and signalling are to be devolved to the line businesses.

8.158. Service timetables and crew duty rosters are prepared centrally by LUL, but local managers put names against duties and are responsible for ensuring that duties are covered. Most lines operate a timetable service at their outer ends and an interval service in the central sections, expressed as so many trains per hour (TPH). The frequency of services in the peak period on most lines is at the practical line capacity, which is mainly governed by the signalling system in use. For example, the Central Line is currently scheduled at 30 TPH, to be increased to 33 TPH on completion of resignalling.

8.159. Restoration of service following disruption for whatever reason is the responsibility of the duty line controllers. The degree and sophistication of control varies from line to line with, for example, a fully computerised system on the central part of the Metropolitan Line and telephone contact with local staff on the Central Line. Problems arise when a train is taken out of service or trains get out of scheduled sequence. When seeking to recover the scheduled service, controllers will sometimes consider it necessary to stop trains short of their intended destinations.

8.160. The Central Line has the oldest signalling, which is being replaced as part of the Central Line Project. Currently it has 13 signal cabins, of which ten are open for the full traffic day. All are located at junctions or where there are sidings and all have a limited span of control. One of the largest cabins, that at Leytonstone, covers the route from just east of Leyton to just west of South Woodford and Wanstead, the first stations on the Epping and Hainault branches. The next signal cabin west of Leytonstone is at Liverpool Street and covers that station only plus two sidings, while west again the next cabin is at Marble Arch, also covering the station only plus one siding.

8.161. Within the areas covered by signal cabins track circuits provide an indication on the signal cabin panel as to which section is occupied by a train. They do not, however, identify that train, control relying on the assumption that it will be the scheduled train unless advised otherwise. Thus control is dependent on telephone reporting of any variations from schedule, such as trains out of sequence or taken out of service.

8.162. Between the areas covered by the signal cabins there is no automatic remote indication as to where trains are. Thus between Marble Arch and Liverpool Street stations, central control may know how many trains are in the section, but not where and not necessarily which ones. Central control for the Central Line, based at Baker Street, comprises two duty controllers equipped with telephones and copies of the operating schedule (timetable). They do not have any computer or other visual display assistance. However, they do have a radio link with train operators, but this is not reliable on the Central Line under emergency conditions. For information on the state of the service they are largely dependent on telephone links with the signal cabins. The whole signalling and control system for the Central Line is now being replaced with the latest available technology. This is expected to resolve most of the problems mentioned above.

8.163. With a combination of track circuits on the conventionally signalled sections and computerised control in the central section, the Metropolitan Line has much better information on the whereabouts of its trains than the Central Line. There are two centurion-level service control managers, in charge of computerised control and conventional signalling respectively. Central control is at Baker Street and exercises control over the route from just west of King's Cross station to just north of Wembley Park station. Outside this section, control is through conventional signal cabins and telephone and radio communication. There are five signal cabins with six control panels, the cabin at Farringdon also having the panel for Aldgate. The other cabins are at Harrow, Rickmansworth, Rayners Lane and Amersham. Each of these cabins covers a more extensive area (up to 10 miles) than those in the Central Line.

8.164. LUL's Business Goal 1 set a target for the maximum number of (scheduled) trains to be running in the peak, at regular intervals, by the end of September 1990. This means single figure cancellations for the network as a whole. With ten lines this implies an average of less than one cancellation per line per peak period. While the number of cancellations has been reduced LUL had still not achieved single figures by February 1991. Cancellations arise mainly because no train is available, either because of defective rolling stock or lack of train crew. A small proportion is due to other causes such as engineering problems with track or signalling giving rise to a reduced service.

8.165. The level of cancellations varies considerably from line to line, with the small East London Line having the best record over the last two years and the Northern, Jubilee and Victoria Lines the worst. The Jubilee and Victoria Lines both experienced technical problems with rolling stock, while on the Northern Line the majority of cancellations were due to lack of train crew, largely because of absenteeism. Management action has now resulted in a significant reduction in cancellations on the Northern Line. This involved a review of maintenance practices at depots (also undertaken on the Bakerloo Line), assisted by consultants, and action to control the level of absenteeism among train crew. LUL told us that the results of the review of Northern Line and Bakerloo Line depots were being applied to other depots.

8.166. Business Goal 1 also specified that trains should run at regular intervals in the peak. On the Central Line, for example, the interval service at peaks should be one train every two minutes. The quality of service target agreed with DTp for achievement by April 1992 is that passengers should not have to wait more than 1.5 times the scheduled interval, that is three minutes on the Central Line. On a network basis LUL has also yet to achieve this target, although there is a variation between lines.

8.167. Disruptions to the regular running of services arise for a number of reasons, not all of which are within LUL's control. By far the most significant of the latter has been the very large increase in the number of calls made to the London Fire and Civil Defence Authority (LFCDA) following reports of smoke or fire since the King's Cross fire and more recently security alerts arising from unattended packages or luggage. Within LUL's control are delays and disruptions arising from equipment failures (power, track, signalling and rolling stock) or from human error such as made by signal or control staff or train crew. For train crew one cause of delay is the failure of a relief crew to be available on time at a changeover point. Delays and gaps in service also arise through trains stopping at stations longer than allowed for in schedules, particularly as a consequence of sheer pressure of numbers in times of peak crowding, resulting in a bunching of following trains.

8.168. Stations are the responsibility of Business Managers through their Group and Duty Station Managers. Group Station Managers are centurion-level posts and may be responsible for one large station, such as Oxford Circus, or several smaller ones. Duty Station Managers and station supervisors provide the management presence throughout traffic hours. They have the direct control of station staff and responsibility for the safe operation of the station, including crowd control. All major equipment maintenance at stations is the responsibility of the Engineering Directorates.

8.169. Following the King's Cross fire, all LUL stations now have contingency plans for evacuation in an emergency. Similar plans have been developed for evacuating passengers from trains trapped in tunnels and a number of practice drills have been undertaken. These arrangements were severely tested in a recent incident on the Central Line involving a security alert at two stations and a suspected fire under a train at a third. In the event it was over six hours before the last passenger was evacuated from four trains trapped in a 1.4 mile length of tunnel. LUL is re-examining its emergency procedures following this incident.

8.170. LUL's Business Goal 3 set a target for a welcoming and customer-friendly environment by April 1991. This has implications for cleanliness, staff presence and attitudes, technology and policing. While the cuts imposed by the current financial situation were likely to have some adverse effect, LUL told us that it saw this goal as primarily concerned with staff performance and attitudes. It was not intended to relate to the physical environment. LUL believed it had gone a long way towards achieving this goal, particularly in relation to cleanliness. However, it was unfortunate that recent security alerts had led to the removal of litter bins from stations; this would make it more difficult to maintain cleanliness.

8.171. Finally Business Goal 4 required `Asset maintenance and renewal so that the system performs well and looks good. This will be a five-year programme covering track, signalling, escalators, stations and trains'. Again, with current financial constraints achievement of this goal will be delayed. However, LUL told us that it was not the intention of the goal to have all assets at the full required standard, rather that the improvements achieved should be clearly apparent to customers.

Conclusions and recommendations

Rolling stock maintenance

8.172. Rolling stock failure rates have been on a rising trend for several years. While this trend has now been arrested the failure rate remains high. Insufficient effort has been devoted in the past to analysing failures, highlighting the real causes and taking appropriate corrective action. In evidence to an internal committee (the Vogel Committee) the RSE described the state of LUL's rolling stock as, at best, mediocre.

He attributed this to a backlog of maintenance and to low standards of maintenance at depots arising from poor specification, inadequate instructional material and training and poor management systems and working conditions. A number of projects to improve the position, including the provision of adequate instruction manuals, have been deferred. We conclude that LUL has devoted insufficient effort to improving the quality of rolling stock maintenance and reducing failure rates. We recommend that LUL should:

(a) take urgent action to improve the provision of proper instruction manuals and the setting of clear quality standards by autumn 1992; and

(b) make greater effort in undertaking failure analysis involving the research and development unit in order to identify the real causes and what modifications to equipment or methods are required.

8.173. Planned preventative maintenance work on rolling stock is undertaken during the normal working day and each line has a number of spare trains above the peak services requirement to allow for this. However, the maximum number of trains is available at night, when the minimum depot labour capacity is available. Only a small number of train technicians (semi-skilled) and train cleaners are on duty at night: LUL told us that it considered that the additional cost in terms of shift premiums may outweigh the benefits and that it would be difficult adequately to staff and supervise preventative maintenance work at night. Nevertheless, LUL felt that there was scope for strengthening the night staff for casualty work to ensure the availability of sufficient trains for service. We conclude that there is a mismatch between the availability of rolling stock for maintenance and the availability of skilled maintenance staff. We recommend that by October 1991 LUL should:

(a) take steps to strengthen the night staff available for casualty work; and

(b) undertake a detailed review of the costs and benefits resulting from introducing two-shift or three-shift working at depots.

8.174. Preventative maintenance work on LUL rolling stock is planned around fixed time intervals. We found that the actual intervals varied significantly from those planned, sometimes shorter but generally longer, particularly for programme lifts. LUL told us that the planned time intervals were indicative and for a number of tasks the actual timing was based on inspection. LUL said that the variations in timing did not affect the safety or reliability of rolling stock. We conclude that, given the wide variations in practice, the planned maintenance intervals do not reflect real need and could lead to overfrequent maintenance and excess costs; nor are they effectively linked to managing or containing failures. We recommend that LUL should review its schedule of planned maintenance in order to relate it more closely to actual needs by autumn 1992.

8.175. The duration of preventative maintenance work, particularly programme lifts and heavy overhauls, was significantly longer than plan (up to two or three times longer) in two depots we examined. This included extended working times, trains withdrawn from service early to ensure availability for maintenance and casualty failures nearly due for planned maintenance being withheld from service to await planned work. LUL accepted that this was a problem and said that it was being examined as part of the current value analysis review. We conclude that maintenance turnround times are excessive and may lead to higher cost. We recommend that:

(a) as part of the current value analysis review LUL should examine planned turnround times to ensure that they are appropriate to the work content using best practice by spring 1992;

(b) LUL should install control procedures to monitor and report depot performance against planned intervals and turnround times by spring 1992; and

(c) trains should not be withdrawn from service prematurely to queue for planned maintenance. Furthermore, that casualties approaching a planned maintenance activity should undergo that activity immediately, using casualty facilities if necessary.

8.176. LUL has recently introduced new, more comprehensive vetting and planning procedures for modifications work. The rate of incorporation of approved modifications is low compared with the outstanding workload. A number of modifications categorised as safety-critical have been outstanding for years. LUL told us that the categorisation system was not entirely satisfactory. Modifications which were essential for safety, such as those to suspension brackets for traction motors on District Line stock, and currently Piccadilly Line stock, were undertaken immediately. Furthermore, LUL told us that it was not satisfied with its records on modifications work and had instituted a census on the state of each train on each line to establish the present position. We conclude that LUL's performance in the incorporation of approved modifications, particularly those related to safety, has been unsatisfactory. We recommend that:

(a) only major modifications should be considered for incorporation by the TMU; minor modifications should be undertaken by depots;

(b) major modification work should be subject to, as far as possible, competitive tenders;

(c) LUL should assign clear responsibility and targets to depot staff for managing the incorporation of modifications and line businesses should take a more positive approach to ensuring that their responsibility is fulfilled; and

(d) LUL should review its system of categorising modifications in order to ensure that appropriate priorities are applied to their incorporation.

Permanent way

8.177. LUL told us that only 75 per cent of its track was satisfactory or adequate in terms of geometry, and that the position was deteriorating as the condition of the ballast worsened. While safety could be ensured by the imposition of speed restrictions, the poor condition of the track had an adverse affect on permanent way maintenance costs and on rolling stock maintenance costs through excessive wear and tear on bogies and suspension members. LUL also told us that the rate of deterioration was such that by the time the new Central Line stock began to enter service the stresses imposed by poor track would be at or near the design tolerances. We conclude that LUL has given insufficient priority to improving track quality in the past and we question whether the current 15-year programme is adequate. We recommend that LUL should seek ways of accelerating the programme (perhaps to the ten-year programme proposed by the Permanent Way Engineer) giving particular attention to lines about to receive new rolling stock.

8.178. LUL told us that its permanent way work was handicapped by a lack of adequate modern equipment (much of the work was labour-intensive, largely relying on hand tools) and by limited access time (usually less than four hours overnight on tube lines). Improvement of the equipment position is dependent on investment currently curtailed because of the financial situation. A project group is at present examining the feasibility of reducing the length of the traffic day to increase access times for permanent way work. We conclude that LUL has devoted insufficient effort to improving working methods and equipment for permanent way work, but we endorse LUL's approach to improving access time. We recommend that urgent attention should be given to improving working methods, the development and provision of more effective tools and equipment and the use of external contractors to provide increased resources.

Signalling

8.179. Resignalling work on the Central Line has not been affected by the present financial situation, but projects for improving signal and control systems on other parts of the network have been deferred. However, LUL told us that the work still being undertaken would result in meeting some targets arising from the Hidden Report and would prevent any deterioration in safety standards. We conclude that, given the present financial situation, the prevention of any deterioration in meeting safety requirements is all that is feasible.

Lifts and escalators

8.180. Partly as a result of the King's Cross fire and the subsequent Fennell Report, the availability of lifts and escalators reached a very low level in mid-1989. Apart from the normal replacement programme for life-expired equipment LUL initiated a crash programme of cleaning and upgrading including the removal of wooden components and the installation of fire detection equipment.

8.181. LUL's Business Goal 2 set a target of no more than 35 escalators out of service for any reason (out of a stock of 274) by April 1991 and required an emphasis to be placed on minimising the downtime of individual machines. The availability target was achieved by March 1991. However, LUL told us that the cutbacks in both the renewal and maintenance programmes imposed by its current financial situation were likely to result in an increase in the number of escalators out of service. The same was true of lifts. We conclude that the recent improvement in lift and escalator availability was commendable. However, we note with concern LUL's view that the position is likely to deteriorate again. We recommend that LUL should ensure that programmes are established for the adequate cleaning, maintenance and upgrading of lifts and escalators; and that the work is planned and controlled to minimise the downtime of individual machines.

Other infrastructure

8.182. LUL is responsible for a large number of bridges, stations, tunnels and other buildings and structures. While the Engineering Directorate is responsible for the stewardship of these assets, including the setting and monitoring of standards, most maintenance, upgrading and renewal work is undertaken by external contractors. In the present financial situation much of this work, other than that essential for safety, has been suspended. LUL is, however, continuing work to improve drainage necessitated by long-term decay and neglect and now also required to cope with the slowly rising water table.

8.183. LUL has introduced a number of improvements to its passenger information systems in recent years, including dot matrix displays on platforms and new public address equipment. CCTV equipment has been fitted at many stations, both to improve crowd control and to enhance passenger security. Further proposals to improve passenger information have been developed but are unable to proceed in the present financial climate.

8.184. LUL's Business Goal 3 set a target for a welcoming and customer-friendly environment by April 1991. This has implications for cleanliness, staff presence and attitudes, technology and policing. LUL told us that it regarded this goal as being concerned primarily with staff attitudes and approach, rather than the physical environment. While significant progress had been made towards this goal, the present financial position and the recent security problems had both had adverse effects. While safety would not be affected immediately, LUL's safety committee considered that the situation would deteriorate should the present financial constraints on maintenance and renewal continue beyond April 1992. We conclude that the constraints imposed by the present financial situation are likely to lead to some deterioration of the physical environment and in staff presence as defined by Business Goal 3, particularly in the next year. However, we accept the need to give priority to those aspects essential to the safe operation of the railway and the safety of passengers and staff.

8.185. For the longer term LUL's Business Goal 4 states `Asset maintenance and renewal so that the system performs well and looks good. This will be a five-year programme covering track, signalling, escalators, stations and trains'. We conclude that this goal will not be achieved in the next five years although improvements should be possible, particularly in track and rolling stock.

Management of existing resources

8.186. LUL's Business Goal 1 set a target for the maximum number of (scheduled) trains to be running in the peak, at regular intervals, by the end of September 1990. This means single figure cancellations for the network as a whole. With ten lines this implies an average of less than one cancellation per line per peak period. While the number of cancellations has been reduced LUL had still not achieved single figures by February 1991, but this was largely due to technical problems with rolling stock on two lines (Victoria and Piccadilly). Cancellations arise mainly because no train is available, either because of defective rolling stock or lack of train crew. A small proportion is due to other causes such as engineering problems with track or signalling giving rise to a reduced service.

8.187. The level of cancellations varies considerably from line to line with the small East London Line having the best record over the last two years and the Northern, Jubilee and Victoria Lines the worst. The Jubilee and Victoria Lines both experienced technical problems with rolling stock, while on the Northern Line the majority of cancellations were due to lack of train crew, largely because of absenteeism. Management action has now resulted in a significant reduction in cancellations on the Northern Line.

8.188. Rolling stock availability and reliability have been considered above and train crew discussed in Chapter 7. We conclude that on the evidence of the Northern Line there is scope for achieving a reduction in cancellations across the network through more vigorous and well directed management action. We recommend that LUL should ensure that the action taken by Northern Line management is applied on other lines where appropriate by October 1991.

8.189. Business Goal 1 also specified that trains should run at regular intervals in the peak. On the Central Line, for example, the interval service at peaks should be one train every two minutes. The quality of service target agreed with DTp, to be achieved by April 1992, is that passengers should not have to wait more than 1.5 times the scheduled interval, that is three minutes on the Central Line. Again on a network basis LUL has still to achieve this target although there is a variation between lines.

8.190. Disruptions to the regular running of services arise for a number of reasons, not all of which are within LUL's control. By far the most significant of the latter has been the very large increase in the number of calls made to LFCDA following reports of smoke or fire since the King's Cross fire and more recently security alerts arising from unattended packages or luggage. Within LUL's control are delays and disruptions arising from equipment failures (track, signalling and rolling stock) or from human error such as made by signal or control staff or train crew. We conclude that LUL's failure to achieve regular service intervals results, in part, from insufficient management attention to those matters within its control.

8.191. We recommend that LUL should:

(a) review its arrangement for dealing with equipment failures in service in order to achieve a more rapid response; and

(b) continue to examine the potential for more effective regulation of station stop times.

8.192. The speed with which normal service can be restored following disruption varies from line to line and depends on the efficiency of control staff, the sophistication of control equipment and the nature of the disruption. At present the Central Line has the least sophisticated system, being largely dependent on telephone contact between the line controller and local staff. Restoration of the scheduled service following disruption can involve the cancellation of some trains and stopping others short of intended destination. Information to passengers in these circumstances is provided through public address systems by the line controller and by local station staff. We conclude that LUL is constrained to some extent by the technology available to it when restoring disrupted services. Nevertheless, much depends on the efficiency and effectiveness of control staff and LUL takes action to identify lessons for the future after each major incident.

8.193. Following the King's Cross fire all LUL stations now have contingency plans for evacuation in an emergency. Similar plans have been developed for evacuating passengers from trains trapped in tunnels and a number of practice drills have been undertaken. These arrangements were severely tested in a recent incident on the Central Line involving a security alert at two stations and a suspected fire under a train at a

third. In the event it was over six hours before the last passenger was evacuated from four trains trapped in a 1.4 mile length of tunnel. LUL is re-examining its emergency procedures following this incident. We conclude that the Central Line incident, albeit an unfortunate combination of circumstances, revealed weaknesses in LUL's emergency procedures. We recommend that LUL should implement the findings of its own review of emergency procedures as a matter of urgency and should consider whether the present rules and regulations governing emergencies are appropriate in all likely circumstances.

9 Matching services to demand

Patronage trends on the Underground

9.1. Underground patronage declined steadily in the early 1970s with a steeper drop after 1974. By 1981 passenger numbers were 18 per cent below the 1972 level, at 541 million. Although there was little data collection during 1982 and 1983, when both fares levels and fares structures saw large fluctuations as a consequence of legal action, LUL believes that 1982/83 witnessed the lowest level of traffic in the Underground's recent history. After 1983 passenger numbers rose each year, up to 815 million in 1988, which saw 50 per cent more passengers than in 1981. The most recent years have seen a flattening of demand. Passenger numbers in 1990 are forecast to be 776 million. Figure 9.1 shows the changes in passenger miles and passenger journeys on the Underground over the period 1981 to 1990. Passenger miles have grown more than journeys, suggesting an increase in average journey length.

9.2. Demand has grown much faster in the off-peak than in peak periods (see Figure 9.2). LUL's springtime station entry counts show a 94 per cent growth in the evening (7 pm to 10 pm) over the period 1981 to 1990, compared with 40 per cent in the morning peak (7 am to 10 am). Off-peak journeys are particularly dependent upon leisure travel. LUL believes that the rapid growth in personal incomes and tourism in London may have increased off-peak travel as a proportion of the total. It is also likely that the growing use of Travelcards, with the implied zero marginal fare for off-peak journeys, has increased the off-peak proportion of travel. Figure 9.3 illustrates the `peakiness' of demand for Underground travel and how this has changed between 1981 and 1989. The proportion of journeys in the six busiest hours (7 am to 10 am and 4 pm to 7 pm) has fallen from 65 to 61 per cent due to the higher growth in off-peak demand and the spreading of the shoulders of the peak.

9.3. Traffic growth has not been the same on all lines. LUL distinguishes between three groups of lines:

(a) low-growth lines: the four lines already heavily loaded in 1981, ie the Central and District from the east, Metropolitan from the west and Victoria from the north;

(b) medium-growth lines: services from the Underground's northern heartland and the District's Richmond branch; and

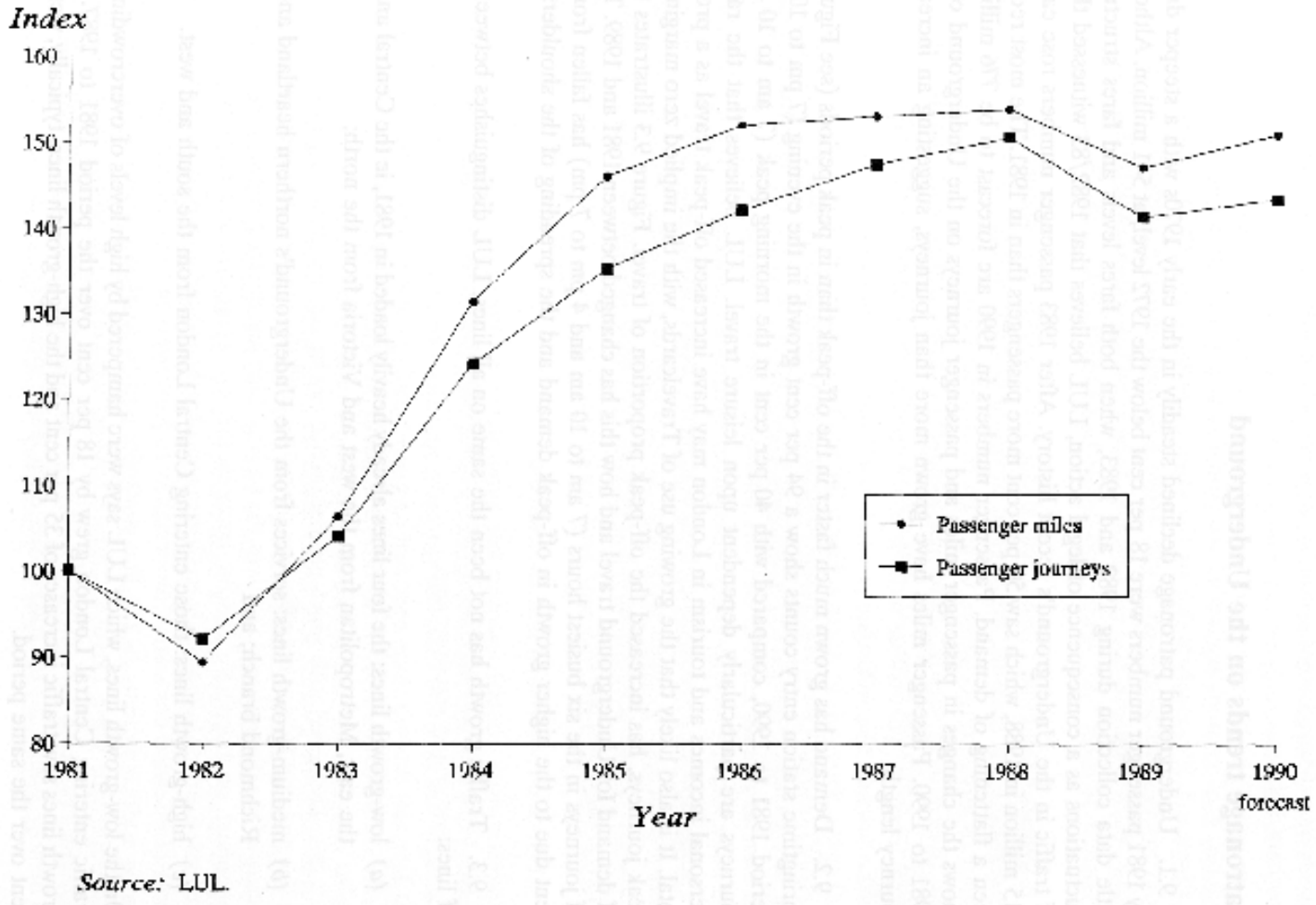
(c) high-growth lines: those entering Central London from the south and west.

On the low-growth lines, which LUL says were hampered by high levels of overcrowding even in 1981, traffic entering Central London grew by 18 per cent over the period 1981 to 1987. The medium-growth lines saw traffic increases of 35 per cent and the high-growth lines, typically, were up by 70 per cent over the same period.

9.4. The overall trends described above mask short-term and local variations following events such as the King's Cross fire, and economic effects such as sudden downturns in tourism in the aftermath of incidents such as major acts of terrorism. These can seriously affect revenues. For example, LUL estimates that income in the first half of 1988 (after the King's Cross fire in November 1987) fell to 5 or 6 per cent below the trend level; of this fall three-fifths was attributed to passenger reaction to the adverse publicity surrounding the Fennell Inquiry.

FIGURE 9.1

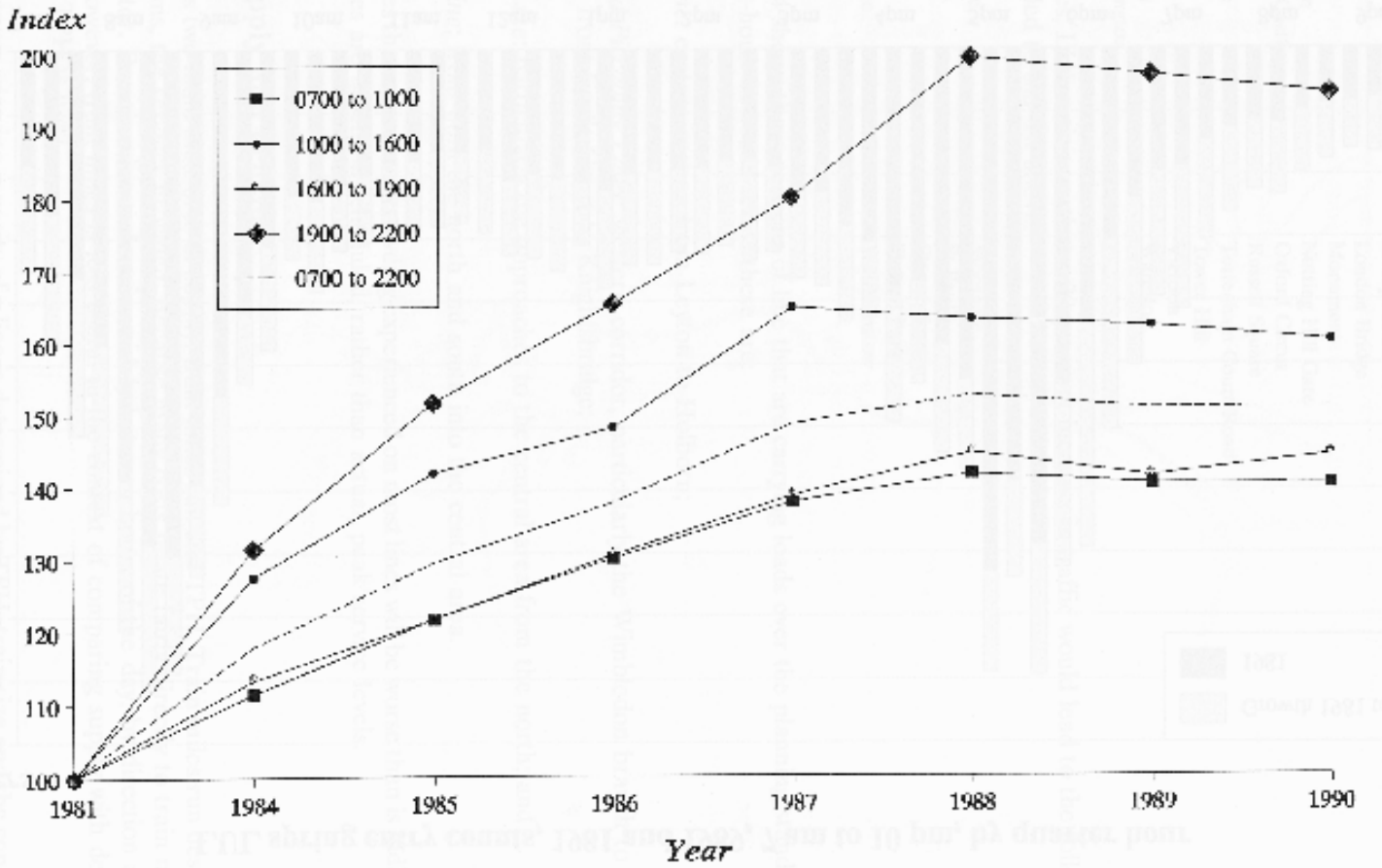
Recent trends in passenger miles and journeys on the Underground
Indexed at 1981 = 100



Source: LUL.

FIGURE 9.2

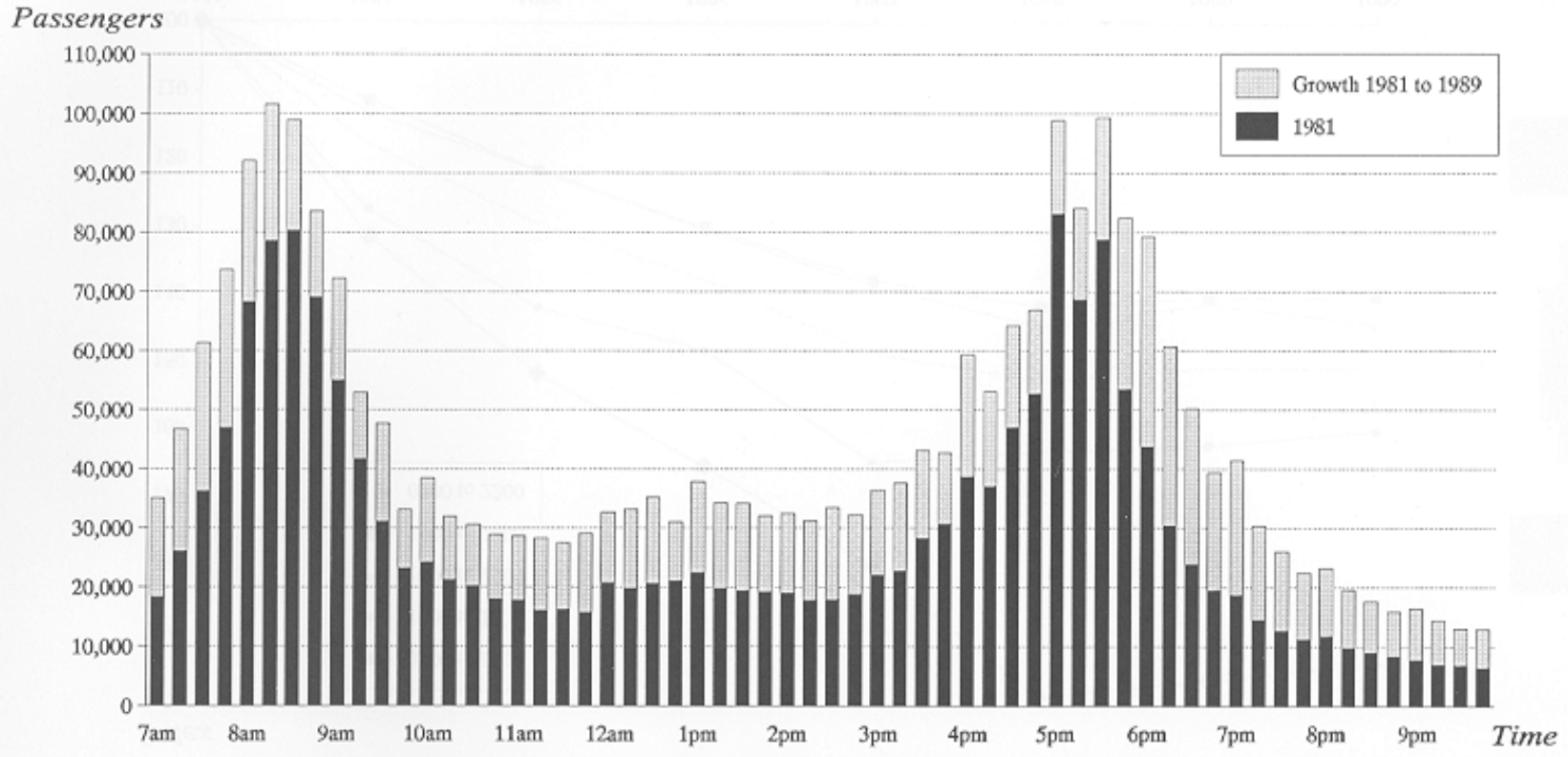
Passengers entering Underground stations by time of day
Indexed at 1981 = 100



Source: LUL.

FIGURE 9.3

LUL spring entry counts, 1981 and 1989, 7 am to 10 pm, by quarter hour



	1981	*1989*	*Growth*	*% in peak*	
Peak (7 to 10 am, 4 to 7 pm)	1,150	1,638	+42%	1981	65%
Off-peak	616	1,058	+72%	1989	61%
Total	1,766	2,662	+51%		

Source: LUL.

Excess demand

9.5. The substantial growth in demand experienced during the 1980s has led to widespread congestion on the Underground during the peaks. In 1988 LUL estimated that the following stations were suffering from `unreasonable' congestion, at 1987 traffic levels:

Angel
Baker Street
Bank (N)
Bayswater
Blackfriars
Brixton
Covent Garden
Elephant and Castle
Embankment
Euston Square
Farringdon
Finsbury Park
Goodge Street
High St Kensington
Holborn
King's Cross St Pancras
Knightsbridge (W)
Liverpool Street
London Bridge
Monument
Notting Hill Gate
Oxford Circus
Russell Square
Tottenham Court Road
Tower Hill
Victoria
Waterloo

If growth continues, LUL estimates that a 30 per cent increase in traffic would lead to the following stations being added to the list above:

Chancery Lane
Charing Cross
Earl's Court
Green Park
Lancaster Gate
Marble Arch
Moorgate
St Paul's
Sloane Square
Tufnell Park
Walthamstow

9.6. Figure 9.4 shows those sections of line that are carrying loads over the planning standard in the morning peak-hour. In broad terms these are:

(a) *Central Line*: eastern section from Leyton to Holborn;

(b) *District and Piccadilly Lines*: western corridor, particularly the Wimbledon branch to Earl's Court and from Earl's Court to Knightsbridge;

(c) *Northern Line*: particularly the approaches to the central area from the north; and

(d) *Victoria Line*: from both the north and south into the central area.

LUL acknowledges that actual overcrowding experienced on most lines will be worse than is indicated, because the figures are based on scheduled, rather than actual, peak service levels.

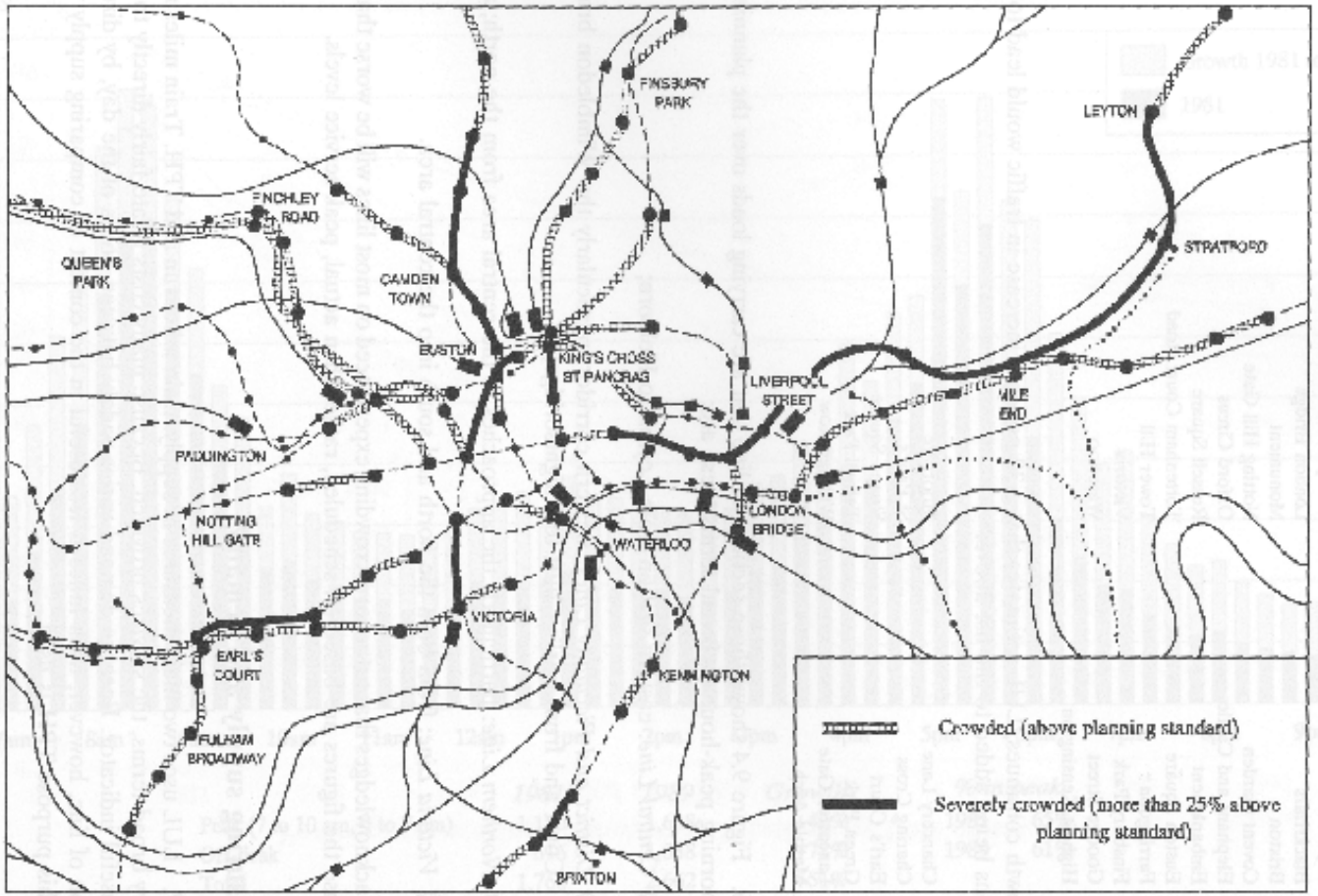
Measuring supply and demand

9.7. LUL uses two main measures of supply: train miles run and TPH. Train miles run describes, in very broad terms, the services provided. Because many costs relate fairly directly to train miles it is a useful indicator. Because demand varies widely between hours of the day, by direction and by section of line, however, train miles is less useful in the context of comparing supply with demand. For this purpose TPH is used.

9.8. The passenger-carrying capacity of a line is determined by TPH, train size and the conditions under which passengers are willing to travel. For planning purposes LUL adopts a standard, based upon the capacity and seating of the rolling stock, which may be broadly summarised as being equivalent to twice as many passengers as there are seats on a train. This defines an acceptable level of loading. This loading, multiplied by TPH, gives line capacity. Typical values are 18,600 passengers per hour with 30 TPH on the Central Line and 17,700 with 32 TPH on the Northern Line. In practice, demand exceeds this standard on some sections of line in the peak. On average, however, LUL supplies around four times as many seat miles as there are passenger miles travelled on the system.

FIGURE 9.4

Crowding on the Underground (morning peak): present day



Source: LT Rail Planning, September 1990.

9.9. Demand expressed in terms of passenger miles is used by LUL as an overall measure of use of the system. It is also a useful indicator of trends in travel, although it does not distinguish between an increase due to the same people travelling further, the same people making more journeys, or new travellers.

9.10. To evaluate changes at particular locations LUL monitors passengers entering the system. In particular, the numbers of passengers using a particular station, or even a bank of escalators within a station, during a peak period are counted and compared with capacity. Similarly, the numbers of journeys between particular stations and routes through the system which go to make up total passenger miles must be known if train services are to be tailored to match demand. LUL carries out a wide range of surveys to collect such information (see Appendix 9.1, paragraphs 1 to 11).

9.11. The use of a zonal fares structure and a wide diversity of ticket types, especially Travelcards, demands comprehensive surveys to obtain a clear picture of system use. In the main there is a satisfactory survey strategy in place to achieve this but there are three areas of concern regarding data collection.

9.12. Passengers entering the system are counted annually at each station, between 7 am and 10 pm on a single weekday. Weekends are counted infrequently and there is no systematic programme of surveys very early or very late in the day. Thus, LUL has only limited knowledge of demand at the margins of the service day and at weekends. As we have discussed in Chapter 8, there are potentially large savings in maintenance and upgrading costs if longer possession times can be made available for engineering works.

9.13. LUL's programmes of entry counts involve surveying each station on a single day in the spring, each year. In the central area, autumn exit counts are also carried out annually, but again on only a single day. It is known that passenger volumes vary from day to day owing to systematic factors, such as the time of year, and also randomly. These single-day counts yield no information on the extent of such variations. In planning station facilities LUL takes account of expected passenger flows, based on the surveys, but no estimate is made of the frequency and extent of abnormally high flows.

9.14. Origin-destination (O-D) surveys of passengers have been carried out at approximately ten-year intervals. The last survey for which data are available was carried out in 1981. Current estimates of passenger miles travelled are derived from updating this O-D matrix to match the one-day entry counts referred to above. Results of the most recent survey, carried out in 1990, are not expected to be available until the autumn of 1991. The updated O-D matrix is the basic input to LUL's demand forecasting models, from which revenue estimates are prepared for the annual Business Plans. As the 1981 survey pre-dates zonal fares, Travelcards and the radical changes in fares which took place in the early 1980s its use as a base for estimating 1990 demands must be questionable.

9.15. UTS gates offer a potentially powerful source of data capture. LUL estimates that 75 per cent of passengers enter or leave the system through a UTS gate and that 50 per cent do both. To date, LUL's concern about the reliability of gate data has precluded their use. However, we have been informed that equipment reliability has improved. Bypass traffic and deliberate closure, or locking open, of the gates as part of crowd-control measures mean that UTS gate data cannot wholly replace direct observations. Nevertheless, the volume of information available could address some of the concerns raised above, in particular that of estimating the size of daily-or even hourly-variations in demand.

Forecasts of demand

9.16. LRT and LUL have carried out substantial research into the factors which determine the demand for Underground travel. They are better equipped than most transport operators in this respect. Despite this, forecasting demand for travel is fraught with difficulty because it depends on the accuracy of other estimates, in particular of economic factors, employment levels and the location of jobs. A description of the forecasting techniques used is provided in Appendix 9.1, paragraphs 12 to 25.

9.17. In recent years LUL's short-term (five years or less) forecasts of demand have all been over-estimates, although generally by less than 10 per cent. This may reflect difficulties in predicting the values of input variables. Table 9.1 presents the forecasts, in terms of passenger miles, which have appeared in recent plans and compares them with out-turn. All these forecasts overestimated demand and, as a result, the revenue was lower than anticipated.

TABLE 9.1 **Comparison of recent demand forecasts with out-turn**

	Demand by year: millions of passenger miles			
Source of forecast	*1987/88*	*1988/89*	*1989/90*	*1990/91*
1987 Strategic Plan	3,908	3,997	4,104	4,185
	(100.5)	(102)	(110)	(109)
1988 Strategic Plan		4,131	4,183	4,232
		(106)	(112)	(110)
1989/90 Budget and Five-Year Plan			3,992	4,030
			(107)	(105)
1990/91 Budget and Five-Year Plan				3,934
				(103)
Out-turn	3,888	3,910	3,738	3,833
	(100)	(100)	(100)	(100)

Source: MMC based on LUL information.

Note: Figures for each year indexed to out-turn (100).

9.18. LUL makes a range of forecasts, with high and low sets of assumptions about input variables, as shown in Table 9.2, although no formal risk analysis is carried out to estimate the likelihood of a particular result. LUL states that `The most notable feature of these forecasts is that the greater risk is likely to be on the down side', ie forecasts are more likely to be overestimates than underestimates.

TABLE 9.2 **LUL's projected change in passenger miles, 1990/91 to 2000/01**

	per cent		
	Low	*Central*	*High*
Peak	-9	4	8
Off-peak	-9	13	18
Total	-9	9	13
Projected revenues (£m) at 2000/01 (1990/91 prices)	645	776	807

Source: LUL.

9.19. It is of particular note that, even under the high forecast, peak demand growth is forecast to be less than 1 per cent per annum. The low forecasts are substantially below the central estimate, whereas the high are only a little higher. Revenues under the low forecast are 17 per cent below the central estimate; in contrast the high estimate adds only 4 per cent. These forecasts reflect LUL's view that labour market constraints are such as to inhibit growth in demand, and that a downturn in the economy, relative to recent years, is likely.

9.20. It should also be noted that these forecasts assume a 3 per cent per annum real increase in all public transport fares. The impact of the proposed Jubilee Line extension and any changes in service quality are excluded.

9.21. Longer-term demand forecasts (over ten years), and assessments of the impact of major investment in new lines, are carried out in the context of London as a whole, in conjunction with BR, DTp and the local authorities. In this context use has been made of the London Transportation Study (LTS) model. This is a transportation planning model originally developed by the GLC and operated on behalf of DTp and the London boroughs since 1987 by consultants. In that time the model has been developed to improve its usefulness in the assessment of rail schemes. Again, estimates of many economic and demographic factors are required as inputs to this model. History suggests that such forecasts are far from reliable. The

complexity and size of the LTS model renders it cumbersome and costly to use: thus sensitivity tests using the model are very limited in extent. LRT is developing a much simpler model, complementary to LTS, called RAILPLAN, which can be used to carry out sensitivity tests and to evaluate variations on the limited number of main options that can realistically be examined by use of the LTS model.

9.22. Estimates of the impact of investment in new lines in the longer term have been made as part of CLRS. The CLRS report states that, by 2001, morning peak rail traffic is forecast to increase by some 15 per cent, with BR trips growing by nearly 20 per cent and Underground trips by about 13 per cent under the `low' assumptions on future employment in London. These forecasts were prepared in 1988. LUL's predictions given in Table 9.2, which were prepared in mid-1990, show demand in 2001 being lower than that predicted by CLRS under the `low' assumption. It would appear that this divergence is due more to changing thinking about the likely values of input parameters than to the differences in the models used. However, LRT holds the view that the CLRS forecasts of Central London employment, which are the main determinant of peak-hour Underground use, remain valid and are supported by current office space developments.

Methods of planning to adjust services to match demand

9.23. The two main methods of adjusting supply to demand are to change the level of supply and to change prices. Because LUL is constrained in its ability to increase its prices (see paragraph 9.26) its main method of adjusting supply to demand is to alter its level of services.

9.24. LRT has a general duty under the LRT Act to provide or secure the provision of public passenger transport services for Greater London having regard to the efficiency, economy and safety of operation. LUL distinguishes between three areas in its planning: long-term, which essentially involves plans for new lines; medium-term, involving new investment in the current system to improve capacity; and short-term, which involves making the most effective use of the current system. Long-term planning for new lines may involve LUL in joint studies with NSE and DTp, and decisions on new lines take into account wide issues such as the future development of London. In contrast the short-term adjustment of services is the primary responsibility of each LGM. Investment to improve the capacity of the current system falls between these two areas; LUL has primary responsibility for developing such plans but they must take account of the longer-term strategy. So, for example, CLRS considered the extent to which present and forecast demand could be catered for by increasing the effectiveness and capacity of the existing network without building new lines and extensions. This led to the development of an MUP which was based on schemes developed by LRT, LUL and NSE. The plans for the new lines were based on the need for additional capacity after the implementation of this programme.

9.25. The justification for investment to increase capacity is based on cost benefit analysis, as described in Chapter 11. In most cases major investment to improve capacity is justified on the benefits to passengers (not reflected in the price charged for the services), safety benefits and the wider benefits to non-users, such as the relief of road congestion. LUL now often judges changes in scheduled services, that do not involve project expenditure, on their effect on operating costs and revenues without taking account of passenger or wider benefits. Consideration is given to passenger benefits, however, when considering more radical changes, such as temporary closures or ending a service earlier in the evening.

9.26. Apart from investment in capacity and other changes in service levels, LUL policy is to use fares increases to reduce congestion and so help alleviate the effect of congestion on the quality of its services and on safety. LUL's 1988 Strategic Plan proposed a real fares increase in peak fares of 15 per cent in 1989 and 1990 and in off-peak fares of 2 per cent in each of these years. The increase in peak prices in 1989 and 1990 would have reduced demand at the peak by 6 per cent. LUL responded to Government pressure not to introduce such high increases. Nevertheless, LUL told us that it still wished to use fares increases to help reduce the level of excess demand. Chapter 10 discusses in detail the current approach to setting fares.

9.27. The following sections describe in detail the methods used to determine adjustments to services in the long, medium and short term.

Long term

9.28. LUL said that there were four driving forces behind new lines: congestion relief; the encouragement of growth of new areas; relieving road congestion; and opening up new areas.

9.29. The focus of LUL's long-term planning over the last three years has been CLRS (see paragraph 3.49). This was set up in March 1988 by the Secretary of State as a joint exercise involving DTp, LRT, LUL and NSE. The primary objective of the work was to `develop a strategy for improving services for passengers on the BR and LUL networks in London, and to provide for forecast demand on the two networks up to the end of the Century, with particular reference to passenger congestion in the area bounded by the major rail termini and their approaches'.

9.30. CLRS was based on a forecast of travel demand in 2001. A key input into the forecast was a forecast by consultants of employment in Greater London. These forecasts, together with other economic and demographic data and projected medium-term service improvements, were combined in the LTS model to produce the forecasts of demand for rail transport described above (paragraph 9.22). Work was undertaken to take account of the effect of congestion on demand which had not previously been allowed for in the LTS model.

9.31. CLRS identified an MUP for the current public transport infrastructure in London which was estimated to cost £1.5 billion. The 1989 report concluded that `This ... would not by itself be enough to cater for the forecast increase in demand and provide acceptable standards of quality for London's rail passengers in the longer term'. Figure 9.4 shows the extent of the current overcrowding on the Underground and Figure 9.5 shows the projected overcrowding in 2001 assuming the completion of the MUP and the effect of the Jubilee Line extension. The report went on to propose two possible packages of new lines. The first involved two BR-gauge tunnels, one joining Euston/King's Cross in the north with Victoria in the south (North-South Crossrail) and the other joining Liverpool Street in the east with Paddington and Marylebone in the west (East-West Crossrail). The second package involved the East-West Crossrail and a tube-gauge line joining Wimbledon to Hainault via Chelsea and Hackney (the Chelsea-Hackney Line). The subsequent report in 1990 identified the East-West Crossrail and the Chelsea-Hackney Line as the best option, with the Crossrail being built first. The Secretary of State has given the go-ahead to further planning, leading to a Parliamentary Bill in November 1991 for East-West Crossrail, and to safeguarding both Crossrail and the Chelsea-Hackney Line. East-West Crossrail is expected to be completed by 1999. No decision has been taken about the timing of the implementation of the Chelsea-Hackney Line.

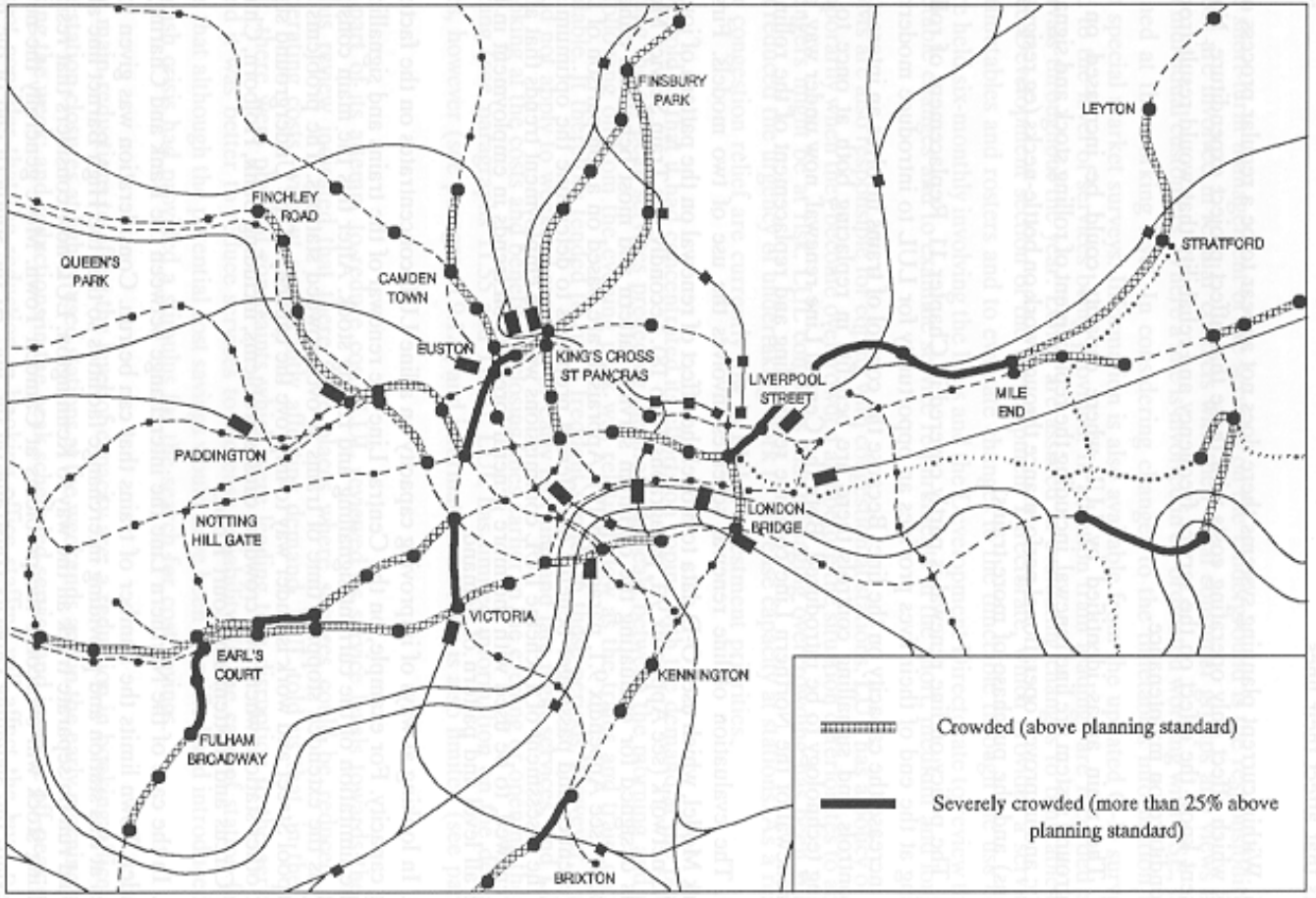
9.32. In addition to CLRS, ELRS was established in January 1989 to examine the best options for improving rail access from Central London to Docklands. This work was undertaken by Halcrow Fox & Associates in consultation with LRT. The preferred option of the report was an extension to the Jubilee Line from Green Park via Waterloo, London Bridge and Canary Wharf to Stratford. The Bill is passing through Parliament and (subject to Royal Assent) work is likely to commence on site early in 1992, with completion by mid-1996.

9.33. Apart from CLRS and ELRS, LUL has a number of proposals for extensions to lines which would not involve new tunnelling, which are relatively cheap and which have high benefits to costs. In particular, such proposals include the East London Line northern and southern extensions and the Croxley Link project to link the Watford branch of the Metropolitan Line to BR's Watford Junction. The extensions to the East London Line involve the conversion of existing rail infrastructure while the Croxley Link project involves an extension of the line by 400 yards. In both cases external funding is being sought but Government funding would also be needed. In addition a number of proposals have emerged from LAS (see paragraphs 3.53 and 3.54).

9.34. LUL told us that although the focus of its current strategy was CLRS, aimed at relieving congestion in the central area of London, it did not consider that the Jubilee Line extension worked against this strategy as it encouraged business development away from the centre. LUL does not consider that it would be sensible to increase access to the centre of London significantly until there is new capacity in the centre to cater for the resulting increase in demand.

FIGURE 9.5

Crowding on the Underground (morning peak): 2001 base



Source: LT Rail Planning, September 1990.

Note: Includes major upgrading programme and Jubilee Line extension.

Medium term

9.35. In the medium term the main focus of LUL's strategy has been to identify ways of increasing capacity on the system, particularly in the central area of London. The last full review of the ways that LUL could increase its capacity was in the Strategic Review of Capacity Enhancement, April 1988, along with CLRS in 1989. Apart from this the co-ordination of the various options for increasing capacity occurs in a number of ways: in developing projects as the various options are considered; in the UIP as priorities are set between different projects, including all projects for increasing capacity; in the Development Directorate as schemes are developed; and in the close liaison with LGMs on projects that affect their lines.

9.36. Within current planning systems there does not appear to be a regular process of comparing options which affect only operating costs with those that affect project expenditure. Nor does LUL at present know the effect on the service frequency and reliability that would result from increasing its expenditure on maintenance.

9.37. The main areas identified by LUL where capacity could be increased on the current Underground system are line renewal, including the replacement of rolling stock and signalling; station capacity; and improved operational performance through work on bottle-necks (eg resignalling critical junctions) and the purchase of more trains.

9.38. The policy on line renewal is partly covered in Chapter 11. Replacement of rolling stock or signalling at the end of their lives provides an opportunity for LUL to introduce modern technology and so increase the capacity on the line. Because the control of trains involves an interaction between train controls and signalling controls there are benefits in replacing both at once to enable new signalling technology to be introduced. Both the Central Line renewal, now under way, and the proposed renewal of the Northern Line combine resignalling and replacement of the rolling stock.

9.39. The evaluation of line renewal schemes involves the use of two models. First, the LUL Network Model, which uses O-D data to model the effect of renewal on the pattern of journeys within the LUL network (see Appendix 9.1, paragraphs 16 to 18). Secondly, the Train Service Model (TSM), which is designed for evaluating the optimum service pattern and most beneficial enhancement to equipment (see Appendix 9.1, paragraph 19). Appraisals are based on a comparison of the marginal costs, revenues and passenger benefits of different proposals to determine the optimum solution. As part of the assessment of a scheme LUL commissions work on employment trends that affect the line being renewed, to be used with the more general forecasts on trends in employment in London and the overall level and pattern of demand.

9.40. In looking at ways of improving capacity on a line LUL concentrates on the factors currently limiting capacity. For example, on the Central Line the renewal of the trains and signalling will overcome the limitation of the current signalling and rolling stock. After this the main constraint on the capacity is the extended stopping time of trains at overcrowded stations. The problems are greatest at Liverpool Street and work is under way to improve the capacity of the Underground station. There are also other stations where overcrowding causes problems, including Bank, Holborn, Chancery Lane, Oxford Circus and Tottenham Court Road.

9.41. In the case of the Northern Line the interchange between the Bank and Charing Cross lines at Camden Town limits the number of trains that can be run. Consideration was given to separating the lines at this station and providing interchange facilities so that the High Barnet line and Edgware line would run on separate track all the way to Kennington. LUL now considers that resignalling and new rolling stock will overcome the problems at Camden Town. More generally the new signalling will alleviate the signalling capacity constraint on the line. At the southern end of the line, capacity would then be limited by the facilities at Morden, which constrain LUL's ability to reduce intervals between train departures. As with the Central Line, another important constraint on capacity is the extended stopping times of trains at overcrowded stations.

9.42. LUL is developing a MICROTRIPS model to be used to identify currently and potentially congested stations. At present the programme for station improvement is based on the stations identified in the 1988 Strategic Review of Capacity Enhancement (see paragraph 9.5). In planning work on stations account is taken both of the costs and benefits of reducing congestion and of the safety considerations.

MICROTRIPS is used to update the priority list of stations being considered for capacity enhancement. Another model, PEDROUTE, is used to plan station layouts.

9.43. Increasing operational performance through work on bottle-necks (eg resignalling critical junctions) and the purchase of more trains is evaluated by LUL through the use of TSM and is based on cost benefit assessment. LUL has a specific strategic initiative to look at such schemes.

Short term

9.44. The short-term management of the services on the Underground is the responsibility of the LGMs. LGMs are involved in regular contacts with their local consumer groups and views are also sought from individual customers. Where a line is involved in co-ordinated working with NSE, contacts are maintained at the working level. In considering changes to the timetables information may be sought from special market surveys. Information is also available from the updated O-D surveys and is compared to the level of services being provided. In addition train loadings are recorded at four-weekly intervals throughout the year. LGMs are assisted in evaluating changes to timetables by the Train Service Development section of the Development Directorate, which provides a service both to compile timetables and rosters and to evaluate changes to the timetable through the use of TSM. Meetings are held six-monthly involving the lines and the Development Directorate to review the need for any timetable changes and to examine service requirements in the short, medium and long term.

9.45. LGMs are also responsible for coping with congestion at stations. LUL has a policy of closing stations temporarily when they become overcrowded and before the situation deteriorates to an extent where passengers might be at risk. LUL considers that managing overcrowding has been successful and this has reduced the urgency of undertaking work to increase capacity at stations. As a result the schemes for congestion relief are currently low in LUL's investment priorities.

9.46. LUL told us that it had concentrated its efforts on coping with the demand at the peak. The cost of running the off-peak services preceding the morning peak, between the morning and evening peaks and following on from the evening peak was relatively low as the trains and train crew were already available. It therefore tended to run a frequent service in these periods. However, the same argument did not apply to weekend services, or early morning and late night services, and LUL was currently looking at the costs and benefits of closing lines earlier in the evening or opening them later in the morning (see paragraphs 11.55 and 11.56). LUL has limited information on the demand for such services, however (see paragraph 9.12), and information on costs is also limited (see paragraph 10.39).

9.47. As part of its attempt to reduce costs LUL reviewed its service levels towards the end of 1990/91. This review indicated that there were places where services could be reduced, thereby reducing operating costs, without significantly affecting demand. LUL told us that, in the case of rolling stock, there were physical constraints which were leading to a disruption to the service and LUL decided it was better to reduce services to increase reliability. In the case of station facilities, LUL told us that although the potential cost savings would have been identified and introduced in due course the cash crisis had provided a stimulus for the search for cost savings.

9.48. The main reductions to affect the level of capacity are: a reduction in booking office staffing levels; more station closures at lightly-used stations at the weekends and in the early morning and late evening during the week; and reductions in the peak scheduled service and in some off-peak services. LUL does not consider that the reduction in booking office staffing will affect the level of service because it has installed POMs. At three lightly-used stations the booking offices will be closed and passengers requiring period Travelcards will have to purchase these at other stations. LUL has not yet decided which stations will be affected by reduced opening hours but has recently announced publicly that little change is envisaged.

9.49. The reduction in the scheduled service at the peak is a short-term measure. LUL estimates that it will save £4 million in a year. Such a reduction in service would normally reduce revenue by £6 million according to LUL's Revenue Model. The current service, however, is unreliable and LUL believes that by reducing the scheduled service it can increase the reliability and so compensate for the reduced services. LUL said that this view was based essentially on judgment although there was some experience from the

Victoria Line. LUL is planning to carry out work to improve its Revenue Model to enable it to reflect the effect of reliability on demand.

Current investment plans to increase capacity

9.50. Because investment to increase capacity is often part of a project to replace current equipment it is difficult to separate out the capacity enhancement element within the UIP. This, therefore, is not normally done by LUL, although the information is available within the individual project appraisals. Table 9.3, taken from the 1991 provisional UIP, shows those projects which have an important element of capacity enhancement.

TABLE 9.3 **Investment plans involving increases in capacity**

£ million, 1990/91 prices

	1991/92	*1992/93*	*1993/94*	*1994/95*	*1995/96*	*1996/97*	*1997/98 to 2000/01*
New lines and extensions:							
Jubilee Line	157.7	391.0	391.2	259.3	108.0	18.0	0.0
East-West Crossrail	14.6	110.9	246.2	455.3	344.0		518.3
Chelsea-Hackney Line	6.0	5.5	11.2	55.7	315.0	} 1,395.5	{
Other extensions	1.5	9.3	52.7	69.7	51.6	0.1	0.5
Line renewal involving increasing capacity:							
Central Line	185.6	148.9	97.7	67.8	14.4	0.0	0.0
Northern Line	0.0	0.0	1.9	8.8	25.0	35.2	618.2
Station capacity	36.4	40.3	38.0	45.5	42.0	42.1	163.4

Source: MMC based on LUL information.

9.51. The largest expenditure on additional capacity is represented by the new lines and extensions. All of this expenditure represents enhancement of capacity. In comparison only a small proportion of the Central Line Project represents expenditure on capacity enhancement.

Co-ordination with NSE and buses

9.52. LUL and NSE compete with each other on some lines and co-ordinate their services on others. Although there is potential for disagreement between LUL and NSE neither organisation expressed any concerns about the co-ordination of their services. The main formal contact between LUL and NSE is at the BR/LRT Liaison Group, which meets seven or eight times a year. This is chaired jointly by the Managing Director of LUL and the Director of NSE. There is also contact between LUL line management and BR route management at local level, both on operational issues, such as the joint operation of stations, and on projects such as the proposed East London Line extension, as well as working level co-operation on shared lines and facilities.

9.53. Because LRT is responsible for both Underground and buses there is the institutional framework for co-ordination within LRT between its subsidiaries. We were told that LUL has in recent years planned its services independently of the buses and that co-ordination between buses and Underground, such as feeder services to tube lines, is a matter for the bus operators. LUL is seeking to improve the level of co-operation and, among other things, has appointed a Service Planning and Liaison Manager with responsibilities including that for co-ordinating with the bus services.

Conclusions and recommendations

Measurement of demand

9.54. The use of a zonal fares structure and a wide diversity of ticket types, especially Travelcards, demands comprehensive surveys to obtain a clear picture of system use. In the main there is a satisfactory survey strategy in place to achieve this but there are three areas of concern regarding data collection.

9.55. Passengers entering the system are counted annually at each station, between 7 am and 10 pm on a single weekday. Weekends are counted infrequently and there is no systematic programme of surveys very early or very late in the day. Thus, LUL has only limited knowledge of demand at the margins of the service day and at weekends. As we have discussed in Chapter 8, there are potentially large savings in maintenance and upgrading costs if longer possession times can be made available for engineering works. We conclude that better knowledge of the revenue implications of a shorter operating day, or of service changes at weekends, could enable LUL to make better use of its resources. We recommend extending basic passenger counts to cover all hours of operation from autumn 1991.

9.56. LUL's programmes of entry counts involve surveying each station on a single day in the spring, each year. In the central area, autumn exit counts are also carried out annually, but again on only a single day. It is known that passenger volumes vary from day to day owing to systematic factors, such as the time of year, and also randomly. These single-day counts yield no information on the extent of such variations. In planning station facilities LUL takes account of expected passenger flows, based on the surveys, but no estimate is made of the frequency and extent of abnormally high flows. We conclude that this is a potentially important missing factor in `sizing' station facilities. We recommend that LUL should measure the variability in passenger volumes, with a view to taking into account in its planning process the probability of abnormally high flows.

9.57. O-D surveys of passengers have been carried out at approximately ten-year intervals. The last survey for which data are available was carried out in 1981. Current estimates of passenger miles travelled are derived from updating this O-D matrix to match the one-day entry counts referred to above. Results of the most recent survey, carried out in 1990, are not expected to be available until the autumn of 1991. The updated O-D matrix is the basic input to LUL's demand forecasting models, from which revenue estimates are prepared for the annual Business Plans. As the 1981 survey pre-dates zonal fares, Travelcards and the radical changes of fares which took place in the early 1980s, its use as a base for estimating 1990 demands must be questionable. We conclude that whilst the updating process is carried out to a high technical standard, we have concerns that the base survey is no longer valid. We recommend that in conjunction with LRT, LUL should carry out more frequent O-D surveys. This should include an evaluation of the case for extending the station exit counts to all stations in order to offer an additional control for updating data from other passenger surveys.

9.58. UTS gates offer a potentially powerful source of data capture. LUL estimates that 75 per cent of passengers enter or leave the system through a UTS gate and that 50 per cent do both. To date, LUL's concern about the reliability of gate data has precluded their use. However, we have been informed that equipment reliability has improved. Bypass traffic and deliberate closure, or locking open, of the gates as part of crowd-control measures means that UTS gate data cannot wholly replace direct observations. Nevertheless, the volume of information available could address some of the concerns raised above, in particular that of estimating the size of daily-or even hourly-variations in demand. We therefore recommend that LUL, in conjunction with LRT, should explore ways in which UTS gate data could be used.

Forecasts of demand

9.59. LRT and LUL have carried out substantial research into the factors which determine the demand for Underground travel. They are better equipped than most transport operators in this respect. Despite this, forecasting demand for travel is fraught with difficulty because it depends on the accuracy of other estimates, in particular of economic factors, employment levels and the location of jobs.

9.60. In recent years LUL's short-term (five years or less) forecasts of demand have all been over-estimates, although generally by less than 10 per cent. This may reflect difficulties in predicting the values of input variables. LUL makes a range of forecasts, with high and low sets of assumptions about input variables, although no formal risk analysis is carried out to estimate the likelihood of a particular result. We conclude that given the difficulties which have arisen in recent years as a result of overestimation of revenue more care is needed in this area. We recommend that LUL should adopt a more critical approach to revenue estimation and should undertake systematic risk analysis to expand on its sensitivity tests.

9.61. Longer-term demand forecasts (over ten years), and assessments of the impact of major investment in new lines, are carried out in the context of London as a whole, in conjunction with BR, DTp and the local authorities; use has also been made of the LTS model. Again, estimates of many economic and demographic factors are required as inputs to this model. History suggests that such forecasts are far from reliable. The complexity and size of the LTS model renders it cumbersome and costly to use: thus sensitivity tests using the model are very limited in extent. LRT is developing a much simpler, model complementary to LTS, called RAILPLAN, which can be used to carry out sensitivity tests and to evaluate variations on the limited number of main options that can realistically be examined by use of the LTS model. We commend this approach, which will enable the demand forecasts for new lines to be revised readily when new information comes to hand.

Passenger benefits and operating decisions

9.62. LUL now often judges changes in scheduled services, that do not involve project expenditure, on their effect on operating costs and revenues without taking account of passenger or wider benefits. Consideration is given to passenger benefits, however, when considering more radical changes such as temporary closures or ending a service earlier in the evening.

9.63. We conclude that the passenger and wider benefits should be taken into account in deciding on changes in service which only affect operating costs as well as on changes that affect project expenditure.

9.64. We recommend that LUL should base its decisions on the level of service it provides using the same criteria for effects on operating costs as for capital expenditure.

Review of investment to increase capacity

9.65. The last full review of the ways that LUL could increase its capacity was in the Strategic Review of Capacity Enhancement, April 1988, along with CLRS in 1989. Apart from this, co-ordination on the various options for increasing capacity occurs in a number of ways:

(a) in developing projects as the various options are considered;

(b) in the UIP as priorities are set between different projects, including all projects for increasing capacity;

(c) in the Development Directorate as schemes are developed; and

(d) in the close liaison with LGMs on projects that affect their lines.

9.66. Within the current LUL planning system there does not appear to be a regular process of comparing options which affect only operating costs with those that affect project expenditure. Nor does LUL at present know the effect on the service frequency and reliability that would result from increasing its expenditure on maintenance. We conclude that there is a need for an annual review of all investment and operating expenditure that affects capacity, in order to ensure that the balance between expenditure in different areas is appropriate, and we recommend that LUL should undertake such a review.

9.67. As part of its attempt to reduce costs LUL reviewed its service levels towards the end of 1990/91. This review indicated that there were places where services could be reduced, thereby reducing operating costs, without significantly affecting the level of demand.

9.68. We are concerned that these savings only appear to have been identified and brought forward as a result of a cash crisis, though LUL told us that these potential cost savings would have been identified and introduced in due course. The cash crisis provided a stimulus for the search for cost savings. We recommend that LUL should regularly review its operating activities to ensure that all its service levels on trains and stations are fully justified by demand.

Matching supply and demand

9.69. LUL told us that it had concentrated its efforts on coping with the demand at the peak. The cost of running the off-peak services preceding the morning peak, between the morning and evening peaks and following on from the evening peak was relatively low as the trains and train crew were already available. It therefore tended to run a frequent service in these periods. However, the same argument did not apply to weekend services, or early morning and late night services, and LUL was currently looking at the costs and benefits of closing lines earlier in the evening or opening them later in the morning. LUL has limited information on the demand for such services, however, and information on costs is also limited. We conclude that there is a need to determine the costs and benefits involved with services at the margins of the operating day and at weekends. We recommend that such analyses should be conducted every two years and that the first should be completed within one year.

10 Fares

Responsibility for setting fares

10.1. Section 8 of the LRT Act requires LRT to exercise control over the general level of fares and services. In practice LRT sets fares for LUL services. There is no statutory control of the fares charged by LRT, although in setting the financial objectives and agreeing the EFL, the Secretary of State may give some guidance as to fares levels or structure.

10.2. Whilst it was controlled by the GLC, LTE was directed to set its fares so as to maximise passenger mileage within overall financial constraints. Fares and service levels were adjusted to encourage the maximum demand that could be achieved within a predetermined level of financial support. It was claimed that this policy was not only simple for management to understand but also ought to lead to the maximisation of passenger and social benefits for the particular grant level set by the GLC. This policy has never been replaced by an alternative statement of fares policy although the formal direction lapsed when LRT was formed in 1984. LRT has, however, indicated that since it ceased to be under the control of the GLC it has stopped basing its fares policy on passenger miles maximisation.

10.3. Initially, when LRT was established in 1984, the then Secretary of State for Transport laid down a direction that fares should be kept broadly in line with prices generally. Subsequently LRT decided, following guidance from the Secretary of State, that it should increase its fares in real terms over a period of years as it developed and improved its services. The objective was that passengers should pay for the day-to-day operation of services and fund a growing amount of the capital programme although it was recognised that the costs of the major expansions to the rail system would have to be met substantially by grant.

10.4. In CLRS published in January 1989 it was assumed that fares would increase in real terms by about 2.5 per cent per annum cumulatively until the beginning of the next century. In the foreword to this document the then Secretary of State for Transport indicated that he agreed with the principle that passengers and other beneficiaries should pay a higher proportion of the cost of providing services and this was the reason for this assumption.

10.5. The LRT Chairman's Planning Statement published in December 1989 stated that fares would be increased by about 3 per cent in real terms in February 1990. LRT had wanted to increase real fares in January 1990 by rather more than this but had been requested by DTp to moderate the increase. The late date at which this request was received meant that LRT had to revise its planned January fares increase and had to delay its fares increase by a month. LRT has told us that it would have liked a further significant increase in real fares in January 1991. However, it was requested by the Secretary of State to keep its cash increase to below double figures and not to alter individual fares by significantly more than this.

LUL's fares structure

10.6. Until October 1981 LUL, in common with the rest of LRT and with BR, operated a system of ticketing based principally on the sale of point-to-point tickets, either single journey or period season tickets, with charging on a scale graduated by distance. Reduced fares were offered for off-peak day returns and a discount applied to the pre-purchase of travel through season tickets. Through booking to/from some BR stations was possible with fares being `summated', but LUL tickets were not generally valid on buses. During much of the 1970s bus and Underground fares scales were different.

10.7. In the late 1970s steps were taken to equalise bus and Underground fares and to develop a simpler ticketing system which would facilitate the pre-purchase of travel by passengers in the form of season or similar tickets. This initiative was driven particularly by the need to reduce the time taken by fares transactions on driver-only buses, so as to speed up this form of operation and permit its extension. Integration of fares and inter-modal ticketing was also seen as a first step in better planning of integrated public transport services.

10.8. In October 1981 the newly elected Labour GLC introduced its `Fares Fair' package. LUL's fares were reduced by an average of 31 per cent. At the same time the opportunity was taken to introduce a major simplification of the London Buses and LUL fares structures. The main feature of the restructuring was to create two charging zones in the central area (City and West End) within which flat fares applied. This represented the first application of zonal fares to LUL.

10.9. The low fares introduced in October 1981 as part of the Fares Fair package proved relatively short lived. Legal action initiated by the London Borough of Bromley led to a decision by the Law Lords that the fares reduction as proposed and implemented was illegal. As a consequence of this decision, fares were nearly doubled in March 1982. The two central area charging zones were, however, retained and the opportunity was taken to restructure the Underground graduated fares scale to intervals of three miles. This had the effect of introducing a *de facto* inner rail zone, with equalisation of radial bus and rail fares for journeys from the Inner Area to a single Central Zone.

10.10. Following a High Court Action between LRT and the GLC to establish the legality of reducing fares to broadly the level that existed prior to the Fares Fair scheme, it was decided that fares should be reduced by on average 27 per cent in May 1983. At the same time the vast majority of LUL stations were brought into a zonal fares scheme by creating five zones, namely:

- Zone 1 — A central zone comprising approximately the area within the Circle Line, with certain additions.
- Zone 2 — An inner zone approximately 3 miles wide around the central zone.
- Zones 3, 4 and 5 — Outer zones covering the rest of Greater London and together forming a suburban ring varying in width from about 9 to 12 miles.

10.11. Season tickets and many bus passes were replaced by Travelcards, which were valid on both LUL and London Buses within the zones purchased, offering to regular passengers for the first time inter-modal travel with one ticket. Both ordinary fares and Travelcards were assessed on the zonal structure. Charges varied according to the number of zones through which travel was made, with no further charge for re-entry to the same zone. Special charging arrangements applied for short-distance cross-boundary journeys, where the full two-zone fare would have been unreasonably high.

10.12. In 1984 a one-day Travelcard was added as an off-peak ticket initially as an alternative to cheap day returns, though the latter have gradually been withdrawn as the scope of the off-peak Travelcard has been increased. The one-day Travelcard is only available after 9.30 am. It can be used in the evening peak period.

10.13. From January 1985 a further period ticket was introduced giving availability within zones on NSE services as well as LRT services. These tickets, sold under the brand name of `Capitalcard', were initially priced 10 to 15 per cent higher than the Travelcard to reflect their wider availability. A one-day version of the Capitalcard was added in June 1986. Capitalcards were also available from BR stations outside the Zone 5 boundary. These offered travel by BR from the selected station to the Zone 5 boundary with onward travel by BR or LRT services including bus, Underground and DLR inside the Zone 5 boundary. These services were competitively priced at a small add-on to the fare from the BR station to its Central London terminal or termini and proved very popular with commuters who wished to use LRT services for onward distribution from the BR terminal.

10.14. In January 1989 the Travelcard and Capitalcard were merged under the common brand name of Travelcard.

10.15. The outer boundary of Zone 5 reflected the old GLC area. The zone extended considerably further from Central London in some directions than others. This was of particular concern to NSE as it meant that fares on some of its radial routes from points at or just outside the Zone 5 boundary had to be held down below their normal level related to mileage from the Central London terminal because of the need to relate fares to the standard all-zones Travelcard. In the January 1991 fares increase the opportunity was taken to split Zone 5 into two zones, thereby creating a Zone 6. Fares from stations in Zone 6 to other zones were increased by slightly more than fares from Zone 5. The current fares structure is summarised in Table 10.1.

10.16. LRT considers that the zonal fares structure and associated Travelcards have been found to offer important benefits compared with the traditional graduated scales related to distance. It has pointed out that:

(a) the integrated approach encourages passengers to use railway services for the main radial movements, and to use buses for feeder and distribution journeys and for local trips in the suburbs, leading to a cost-effective use of resources;

(b) Travelcards generate both additional travel (mostly off-peak) and extra revenue, as passengers increasingly recognise the convenience and value of the tickets;

(c) the scope for fraudulent travel is reduced as opportunities to `override' are reduced and ticket checking can be concentrated in relation to zonal boundaries; and

(d) the ticket-issuing task is reduced and this has allowed OPO on buses through faster boarding speeds.

Fares levels, patronage and revenue

10.17. As the previous section has described, both the structure and the level of fares on LUL have varied considerably and at times rapidly in the last ten years. This has affected LUL's patronage and revenue. Figure 10.1 shows the movement in the real fares index (calculated on a compound basis at each fares increase), passenger miles, the real revenue per passenger mile and the real traffic receipts over the period 1971 to 1990. It can be seen that:

(a) Over the period 1971 to 1980 real fares and real revenue per passenger mile both increased by about 50 per cent. Total real income increased by only 23 per cent because of an 18 per cent reduction in traffic carried.

(b) The real fares index peaked in 1982 at a level 63 per cent higher than 1971, fell to a low only 21 per cent higher than 1971 in 1984/85, and has since risen to a level 40 per cent higher than in 1971.

(c) Since 1980 real income per passenger mile has fallen much more than real fares. This in part reflects the introduction of the Travelcard, which has generated additional traffic, and in part reflects a growth in longer-distance travel, which is charged at a lower rate per mile. Over the period from 1980 to 1990/91 the real income per passenger mile has fallen by 24 per cent although real fares calculated on the basis of annual compound fares increases have only fallen by 7 per cent.

(d) Total real revenue has increased by 13 per cent over the period from 1980 to 1990/91. This is a slower rate of increase than in the previous ten years, when real fares increased by 50 per cent. In 1990/91 real fares were 7 per cent below their 1980 level.

TABLE 10.1 **Specimen fares as at May 1991**

£

	Average distance (miles)*	*Single*	*Return*	*Cheap day return-one-day Travelcard*	*LT Card*	*Weekly Travelcard*	*Monthly Travelcard*	*Annual Travelcard*
To or via Zone 1								
Zone 1 to Zone 1†	-	0.80	1.60	-	-	7.80	30.00	312.00
Zone 2 to Zone 1‡	3.5	1.10	2.20	2.30	3.50	10.00	38.40	400.00
Zone 3 to Zone 1§	6	1.40	2.80	2.70	4.50	13.80	53.00	552.00
Zone 4 to Zone 1¶	8.5	1.80	3.60	2.70	4.50	17.20	66.10	688.00
Zone 5 to Zone 1¤	11	2.20	4.40	3.10	5.50	21.60	83.00	864.00
Zone 6 to Zone 1**	13.5	2.30	4.60	3.10	5.50	22.00	84.50	880.00
Zone 2 to Zone 2 (via Zone 1)	-	1.10	2.20	2.30	3.50	10.00	38.40	400.00
Outside Zone 1								
Zone 2 to Zone 2 (one zone)	-	0.50	1.00	-	-	4.60	17.70	184.00
Zone 3 to Zone 2 (two zones)	-	0.80	1.60	-	-	7.80	30.00	312.00
Zone 4 to Zone 2 (three zones)	-	1.20	2.40	2.60	-	11.70	45.00	468.00
Zone 5 to Zone 2 (four zones)	-	1.50	3.00	2.60	-	14.30	55.00	572.00
Zone 6 to Zone 2 (five zones)	-	1.60	3.20	-	-	14.60	56.10	584.00
Zone 6 to Zone 3 (four zones)	-	1.30	2.60	-	-	12.00	46.10	480.00
Zone 6 to Zone 4 (three zones)	-	0.90	1.80	-	-	8.20	31.50	328.00
Zone 6 to Zone 5 (two zones)	-	0.60	1.20	-	-	4.80	18.50	192.00
Zone 6 to Zone 6 (one zone)	-	0.50	1.00	-	-	4.60	17.70	184.00

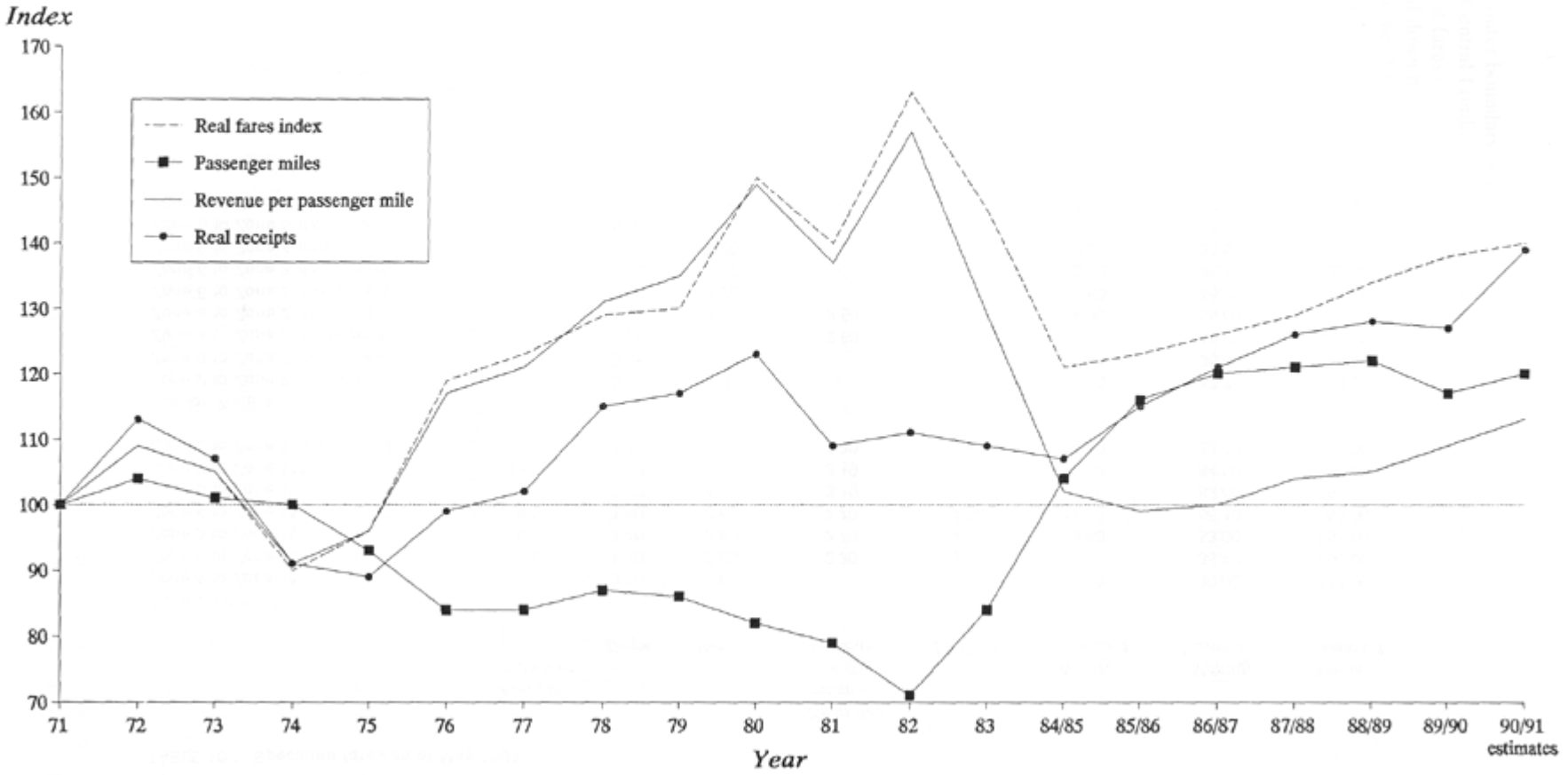
Source: LUL.

---

*The average distance is measured from Piccadilly Circus.
†Zone 1 extends up to 2.75 miles from Piccadilly Circus.
‡Zone 2 extends from 2 miles to 5 miles from Piccadilly Circus.
§Zone 3 extends from 4 miles to 7.75 miles from Piccadilly Circus.
¶Zone 4 extends from 6.75 miles to 10 miles from Piccadilly Circus.
¤Zone 5 extends from 9.75 miles to 12.75 miles from Piccadilly Circus.
**Zone 6 extends from 12 miles to 16 miles from Piccadilly Circus.

FIGURE 10.1

LUL real fares, demand and revenue, 1971 to 1990/91



Source: LUL.

More details of the movement in passenger mileage and real fares on a year by year basis are shown in Table 10.2. Passenger mileage which fell by 18 per cent over the period from 1970 to 1980 increased by some 50 per cent over the period from 1980 to 1988/89 but has since fallen back slightly.

TABLE 10.2 **Changes in passenger mileage and real fares, 1971 to 1990/91**

Year	*Passenger miles (million)*	*Real fares index 1971=100*	*Passenger miles index 1971=100*	*Percentage change on previous year* Real fares	Passenger mileage
1971	3,205	100	100	-	-
1972	3,321	109	104	+9	+4
1973	3,246	105	101	-4	-3
1974	3,210	90	100	-14	-1
1975	2,967	96	93	+7	-7
1976	2,706	119	84	+24	-10
1977	2,699	123	84	+3	-
1978	2,800	129	87	+5	+4
1979	2,770	130	86	+1	-1
1980	2,640	150	82	+15	-5
1981	2,540	140	79	-7	-4
1982	2,270	163	71	+16	-10
1983	2,700	145	84	-11	+18
1984/85	3,340	121	104	-17	+24
1985/86	3,710	123	116	+2	+12
1986/87	3,862	126	120	+2	+3
1987/88	3,888	129	121	+2	+1
1988/89	3,910	134	122	+4	+1
1989/90	3,738	138	117	+3	-4
1990/91 (estimated)	3,833	140	120	+1	+3

Source: MMC based on LUL data.

Concessionary fares

10.18. Three major concessions for certain categories of users are available from LUL. These are:

(a) child rates;

(b) free travel for the elderly and disabled; and

(c) scholars' term tickets.

10.19. Child rates are available to children aged between five and 15 years inclusively, across the range of tickets offered. Children under five years of age travel free. The percentage reduction for children varies from 40 to 60 per cent for ordinary tickets and from 35 to 75 per cent for Travelcard. These substantial reductions have remained from the time when the GLC's policy was to set very low fares for children. LRT now wishes to reduce progressively the level of discounts offered to children.

10.20. LRT and the London boroughs operate a scheme under sections 50 to 53 of the LRT Act whereby travel passes are issued free by the boroughs to their elderly, blind and handicapped residents. Payment is made by the boroughs to LRT on the basis of an annual negotiation, reflecting estimated use made of such passes, current fares levels and travel generated by their availability. LRT considers this system generally works well, to the satisfaction of all parties concerned.

10.21. Certain scholars also benefit from free travel on specific LRT/LUL services for which full payment is received from the local education authorities.

The method of determining the level and structure of fares

10.22. We are required by our terms of reference to investigate and report on the method of determining the level and structure of fares and the relationship of fares both to cost structures and to the level of peak and off-peak demand on the network.

10.23. Section 8 of the LRT Act states that `It shall be the duty of LRT to exercise their control over any subsidiaries so as to determine the general level and structure of the fares to be charged for public passenger transport services provided by LRT or any subsidiary of theirs'. This duty has to be set in the context of the general duties set down in section 2 of the LRT Act including:

(a) the requirement to co-operate with BR; and

(b) the financial duty in section 15 of the LRT Act and its duty to conduct its affairs with a view to achieving any financial objectives determined for it by the Secretary of State under section 16.

LRT's current principal strategy for fares as set out in the Chairman's Planning Statement of December 1989 is to:

> Increase fares over the next few years as the quality of service improves and Londoners' incomes grow. This will mean that passengers pay for the day to day operation of services and fund a growing amount of the costs of the capital programme. However, LRT believes the cost of expanding the rail system as proposed in the Central and East London Rail Studies will have to be met substantially by grant even after developer contributions have been taken into account.

10.24. In the Chairman's Planning Statement it is also stated that it is LRT's strategy to `develop fare collection systems so that fares can be targeted and differentiated with accuracy and equity between modes and by times of day'.

10.25. LRT normally raises fares once a year, usually in early January. NSE fares are raised on the same date. The revised fares are worked out during the course of the preceding year.

10.26. Whilst the ultimate responsibility for determining future fares levels rests with LRT, the subsidiary operating companies including LUL make suggestions and are involved in the process of preparing recommendations on fares for the LRT Board's consideration. For this purpose LRT has established a Fares Revenue Committee chaired by the LRT Director of Planning which includes representatives from LUL's finance and marketing functions who clear points of principle with the LUL Board. This committee meets approximately monthly and considers both the details of the next fares increase and also longer-term issues related to ticketing procedures and fares strategy. During the course of the year proposals for the next fares rise are considered. Informal discussions are also held with DTp as to the level of fares rise that the Secretary of State would be likely to permit for the coming year. The recommendations of the committee are then presented to the LRT Board for final consideration and approval.

10.27. In its 1990 Business Plan LUL stated that it was its objective to set fares levels which would reduce peak crowding and achieve profitability. It pointed out that the 1988 Strategic Plan envisaged real increases of 15 per cent in its first two years. This would have been sufficient to generate an operating profit in 1989/90. In the 1989 Business Plan these figures were no longer regarded as realistic and 5 per cent real growth was assumed, generating an operating profit in 1993/94. In the 1990 Business Plan it was assumed that real prices would increase by 3 per cent per annum, in line with the increase implemented in February 1990. At this rate of increase LUL was forecast to continue to make an operating loss in all years of the plan, through to 1995/96, with the loss falling, however, over the period 1990/91 to 1995/96, from an estimated £136 million to £4 million.

10.28. In fact in 1991, at the request of the Secretary of State, real fares were held below 10 per cent close to the prevailing level of inflation although the anticipated level of inflation during the course of the year may be lower than the observed inflation in the previous year.

10.29. The 1990 Business Plan states that LUL is already seeking to maximise revenue within the fares rises indicated. The whole area of revenue collection is one which will attract increasing attention in future years, as new technologies such as Touch and Pass and Stored Value Ticketing (SVT) are examined. Better means of targeting fares will be necessary both to maximise income and to achieve the right balance between peak and off-peak fares.

10.30. LUL states that its short- to medium-term marketing strategy seeks to influence demand to match the availability of capacity on the network. A combination of pricing, new fares products, advertising and local initiatives will be used to improve the balance between demand and supply. With this in mind the increase in fares from February 1990 was weighted towards journeys into and within the heavily congested Central Zone.

10.31. Future pricing policy in the short term will be based on matching supply to demand. For example, consideration is being given to differential peak/off-peak pricing for certain single tickets and return journeys. Restrictions on travel in the evening peak are being considered for one-day Travelcards to the central area; this might be matched by the introduction of a new all-day Travelcard which would be valid in both the morning and evening peaks. All lines will be looking for local marketing opportunities, especially to promote off-peak travel. For the longer term, SVT is being studied to see what benefits this may have.

Fraud

10.32. As part of the policy of maximising revenue within a given level of fares rises, LUL is determined to reduce fraud. It has taken the following steps to this end:

(a) the final stage of implementation of the existing UTS gates, so that all customers will have to pass through the gates on entry and exit within Zone 1;

(b) improved ticket checking at station barriers outside Zone 1;

(c) the introduction of a Revenue Protection Manager on each line, with line-based revenue protection teams carrying out ticket inspections on trains and stations; and

(d) the use of line-based fraud surveys to monitor fraud levels and set targets for reduction.

LUL told us that it believes that by these means it has reduced fraud from roughly £35 million per annum to around £15 million per annum.

10.33. LUL has employed consultants to consider the possibility of extending UTS gates throughout the network as a means of reducing fraud. The consultants concluded that full gating of the Underground might be justified financially to reduce fraud but that the case was not strong, as fraud levels had already been significantly reduced.

The relationship of fares to costs

10.34. LUL does not consider it appropriate to carry out routine analysis of costs by route, section of route or time of day. It is therefore difficult to relate the fares charged for particular journeys to the costs of those journeys. At a late stage in our inquiry LUL did provide us with the results of some work carried out in 1984. This suggested that the cost of providing an extra train mile in the peak was three times the cost of doing so in the off-peak. This work assumed that the capital costs of rolling stock were all incurred in the peak, and that no allowance was made for either the capital or the maintenance costs of providing the basic track and signalling infrastructure.

10.35. We have been told by LUL that it considers it desirable to have a fares structure which reflects:

(a) the cost incurred by different kinds of passenger trip (which is dependent on the length, location, timing etc); and

(b) the strength of demand in the various submarkets (work, leisure, etc).

LUL claims that, in practice, both the cost- and market-based approaches to pricing often lead to similar conclusions. Thus in recent years, whilst fares have been market-led, policy has aimed to increase peak fares relative to the off-peak and to increase radial and Central London fares relative to suburban fares.

10.36. As a result the changes in fares have taken account of the inherently higher cost of the central area, which arises from such factors as:

(a) the predominance of deep-level and subsurface structures and the consequent need for lifts and escalators;

(b) station capacity constraints and moving machinery requiring a substantial staff presence for safety; and

(c) the significant track mileage in single-bore tube tunnels which restricts much maintenance and renewal to outside the traffic day.

These factors are reflected in the zonal pricing scale, with higher fares charged in to and from Zone 1.

10.37. LUL has also stated that journey costs are significantly determined by station use and hence a strictly distance-proportionate scale would not be appropriate. Station costs in the outer zones are generally lower than those of Zone 1, and prices to/from the centre reflect these factors.

10.38. We have also been told that, whilst time-of-day costing is not routinely undertaken, desk analysis suggests that congestion is the significant variant on short-run marginal costs and capacity that on long-run marginal costs. This leads to the conclusion that costs are higher in the peak in the central area where congestion and capacity constraints apply, and this conclusion underpins both LUL's policy of discounting off-peak travel and its moves to establish peak travel in Zone 1 as a premium product.

10.39. Whilst there can be little doubt that the costs of operation per train mile are higher in the central area than in the suburbs, and in the peak than in the off-peak period, LUL has not been able to provide any recent quantitative estimate of the extent of this difference. In particular, it has not been able to demonstrate whether:

(a) after allowing for the difference in average loading per train and frequency of service operated, unit costs per passenger are actually higher in the peak than the off-peak or in the central area compared with suburban areas; and

(b) the average fare paid per passenger mile is markedly higher or lower in the central area as compared with suburban areas and in the peak as compared with the off-peak.

10.40. We also discussed with LUL whether the present zonal fares system enabled it to set prices which reflected the costs of individual journeys. LUL told us that in the design of the six-zone system it was balancing simplicity, which made for operational ease and passenger convenience, against more complicated structures which attempted to match the market more finely.

The relationship of fares to the level of peak and off-peak demand on the network

10.41. It is LUL's strategy to set fares levels which will reduce peak crowding. This objective can of itself be used to justify LUL's policy of charging higher fares in the peak period even if the claimed higher costs of providing a service in the peak period cannot be proven.

10.42. LUL has also pointed out to us that the elasticity of demand for peak travel is usually considerably lower than for off-peak travel so that an increase in peak fares generates proportionately more revenue than a similar percentage increase in off-peak fares. This means that so long as LUL is trying to maximise the net revenue yield of a given average level of fares increase then it is sensible to raise peak fares by a higher percentage than off-peak fares.

10.43. However, a number of third parties commented that for LUL to raise peak fares was highly undesirable. They pointed out that:

(a) many of those travelling at peak periods were dependent on LUL for essential journeys to work;

(b) the quality of service offered in the peak period was much lower than the rest of the day and it was unfair to charge people more for travelling in the worst conditions; and

(c) charging people more to travel by Underground in the peak period would cause an undesirable switch from public to private transport.

10.44. In order to encourage off-peak travel LUL offers one-day Travelcards at a substantial discount. These are not available until after 9.30 am. LUL does not consider that the effect of the promotion of the one-day Travelcard on the evening peak is at present a problem. In the past the main concern has been the morning rush-hour where demand has been more peaked. The Travelcards are, however, valid throughout the evening peak and demand at the evening and morning peaks is now very similar. We understand that consideration was given to restricting the use of one-day Travelcards in the evening peak but that this was rejected on the grounds that it could be difficult to implement and might cause problems if passengers were rushing to use the system before the evening peak commenced.

10.45. Period Travelcards are available for a minimum of seven days or more and effectively permit Travelcard holders, once they have purchased a ticket, to travel when they like, including during both peak periods, at zero marginal cost. A weekly Travelcard from Zone 6 is currently charged at 9.6 times the daily rate for a single ticket from that zone to Zone 1. There is a considerable body of opinion within LUL that period Travelcards are at present significantly underpriced in relation to standard single journey tickets. LRT's ability to raise the price of Travelcards relative to single journey tickets has, however, been constrained in the last two years by the reluctance of the Secretary of State to permit LRT to raise individual fares by significantly more than the rate of inflation.

Allocation of Travelcard revenue

10.46. The revenue from Travelcard is divided between the participating operators in proportion to the passenger mileage on each mode. In the case of Travelcards issued from BR stations outside Zone 6 the mileage relates to all mileage inside Zone 6, and the revenue is the price of a normal Zone 6 Travelcard. LUL is unhappy that this formula does not fairly reimburse it for the high costs of the relatively short journeys carried out by combined Travelcard/BR point-to-point tickets sold to commuters living outside London. It has also pointed out that BR often charges significantly more for these outside Zone 6 Travelcards compared with a normal season ticket to Central London than it passes on to LRT as LRT's share of the Travelcard revenue. In other words BR is making a profit from the surplus it charges its passengers to buy a Travelcard for journeys very largely made using LRT and, in particular, LUL services.

10.47. BR does not deny this. It has, however, pointed out that in its current financial position it cannot afford to lose revenue. The rates initially set by LRT for the Travelcard were significantly lower than BR would normally expect to charge using its mileage-based tariff for equivalent period season tickets to its Central London rail termini. It has therefore had to hold back its season ticket rates so as to make them comparable with Travelcard. As a result it has lost significantly more revenue than it has been able to recoup from the add-on it charges combined Travelcard/BR point-to-point ticket holders from outside Zone 6. It considers that the solution to this problem is to raise the price of Travelcards to a level that more closely reflects the costs of catering for Travelcard users and the relative value Travelcard holders gain from their tickets.

10.48. We understand that, because it could not reach a satisfactory agreement with BR, LUL indicated that it wished to abandon the Travelcard agreement with BR in so far as it related to longer-distance journeys from outside London. It was, however, instructed by the then Secretary of State not to do so. Instead, LRT is now considering the introduction of its own Travelcard add-on which would be sold to BR season ticket holders from outside Zone 6 for less than the current excess that BR charges for a Travelcard as compared with a normal season ticket to its Central London termini.

The one-day Travelcard

10.49. LRT wishes to introduce an All-Day One-Day Travelcard. BR has only been prepared to introduce such a ticket at a tariff level which LRT considers unreasonably high, on the grounds that it would otherwise lose revenue from the introduction of such a card. In May 1991 LRT is introducing an All-Day One-Day Travelcard valid only on LRT services. We asked LRT why it wished to introduce such a card given that it might appear to contradict some of its key objectives, namely:

(a) to maximise net revenue; and

(b) to discourage additional travel in the peak period.

10.50. LRT responded that it considers that the new ticket caters for a group of passengers who will find it convenient and attractive and that prices are being pitched so as to render the risks of revenue loss minimal. It considers that the additional travel will be mainly in the off-peak. LRPC told us that it strongly supported the idea of an All-Day One-Day Travelcard and had for some time been pressing LRT to introduce it.

Stored Value Ticketing

10.51. LRT is considering for the longer term the case for, and feasibility of, a system of SVT based either solely on the same magnetic technology employed by the UTS gates or with appropriate add-on advanced technology which is now available. It has been felt that SVT might enable LRT to target fares better both to different travel modes and by time of day.

10.52. A working party was set up to examine the potential for SVT. It concluded that it was unlikely that it would be practicable and worthwhile to consider introducing SVT to LBL or DLR in the immediate future. There might, however, be a case for introducing SVT to the Underground.

10.53. The main disadvantage of extending SVT to the Underground is the cost of providing UTS gates at the majority of stations not already covered by the system. This has been estimated to cost in excess of £90 million. It was concluded that the application of SVT to the whole network may be financially worthwhile, though this conclusion is very sensitive to variations in the estimates of benefits and costs.

10.54. The working party recommended that, subject to the necessary financial provision, LUL should initiate work on preparing a detailed technical specification and implementation timetable for a Zone 1 trial of SVT. A final decision on whether to proceed with this trial would, however, depend upon further research including a review of the practicability of operating SVT at stations where gated entry or exit is not possible. LUL/LRT would also need to take a view before implementing the trial that SVT was a potentially acceptable longer-term strategy for the Underground.

Statement of future fares policy

10.55. The Fares Revenue Committee has been considering whether LRT needs to develop a revised statement of its fares policy and has put forward suggestions for consideration by the LRT Executive Committee. These views have not yet formally been accepted or rejected by LRT and may be influenced by the response to LRT's recently published Consultation Document 1991 to 1994, in which LRT has asked for views on issues relating to fares, ticketing and funding.

10.56. LRT states in its Consultation Document that the quality of service provided is an important consideration in setting fares and that if improvements are to be made in services passengers will have to make a contribution. LRT also indicates that the possibility of increasing the differentials between peak and off-peak fares to encourage travel outside the most congested periods remains under consideration and any real fares increase could also contribute to moderating peak demand. On ticketing issues the Consultation Document states that, while innovations and modifications always have a place, there are no plans to change the broad structure that currently exists. In particular LRT recognises the popularity and perceived benefits of the Travelcard to the travelling public in London arising from the flexibility afforded between tube, bus and rail.

Conclusions and recommendations

Statement of fares policy

10.57. LRT is responsible for controlling the general level of fares policy. Its policy is to increase fares in real terms towards a point where LUL's revenue covers all costs of LUL's operations. It does not at present have any formal guidelines as to how this can best be done, and in particular what weight should be given to the needs and costs of catering for different types of traffic. The Fares Revenue Committee has, however, recently prepared a revised statement of fares policy which has been sent to the LRT Executive Committee for consideration. The recent LRT Consultation Document 1991 to 1994 comments on fares policy and seeks the public's views.

10.58. We consider that LRT should, as soon as possible, spell out more clearly, both for the benefits both of its own staff and of its passengers, a clear description of its fares policy. We therefore recommend that LRT should agree and by the end of 1991 publish a revised statement of its fares policy.

Level of fares

10.59. Even though the Government had earlier indicated that it expected LRT to plan on the assumption of real price increases LRT, and hence LUL, has not recently been able to implement the preferred strategy of raising fares as much in real terms as it intended because of Government concern.

10.60. We conclude that this seriously damages LUL's ability to plan its medium-term strategy on a consistent basis. Whilst we appreciate that the Government wishes to retain the right to influence fares policy in the short term, the current system may not be the most efficient way of so doing. Instead we recommend that LRT and DTp should consider establishing a long-term contractual relationship based on the review, discussion and approval of LRT's strategic plans. This contract should include an agreement on the level of annual real fares increases which will be permitted to LUL during the period of the Strategic Plan and the formula by which such increases will be calculated. If DTp were then to decide that a different policy in respect of LRT's fares were more appropriate, LRT should receive a compensatory grant to make up for any resulting shortfall in funds. We further recommend that, if possible, agreement on such a contract should be completed prior to the publication of LRT's next Strategic Plan.

Structure of fares

10.61. LRT's, and hence LUL's, ability to change its fares structure has recently been constrained by requests from the Government not to raise individual fares by significantly more than the overall average real fares increase.

10.62. We believe that this undesirably reduces LRT's freedom to adjust its fares to meet its policy objectives. We therefore recommend that LRT should be given greater freedom to alter individual fares within any agreed average overall percentage increase for all fares.

Relationship of fares to costs

10.63. Many of the costs of providing LUL's services are joint costs, and not specific to the operation of individual services at particular times of day. Other costs are specific to particular services. LUL carries out occasional analysis of the costs of operating specific services. It does not, however, prepare regular estimates of the costs of operating specific services on different sections of its network at different times of the day.

10.64. We believe that, notwithstanding the difficulties of allocating costs to specific routes at different times of day, the preparation of line-specific and, where appropriate, section-of-line- specific costs on a regular basis would:

(a) help LUL to set fares which more truly reflected costs; and

(b) help to identify those services which were not covering their marginal costs of operation.

10.65. We recognise that there are important conceptual problems in deciding what costs are incurred by, and are therefore specific to, particular lines or services. Nevertheless we recommend that LUL should institute a regular system for estimating costs by section of line and time of day as part of its ongoing management information. This system should be introduced within one year from publication of this report.

Zonal pricing system

10.66. LRT has told us that in the design of the six-zone system it is balancing simplicity, which makes for operational ease and passenger convenience, against more complicated structures which attempt to match the market more finely.

10.67. We believe that it would be desirable to study in more depth the arguments for and against the current zonal system. We therefore recommend that LRT should carry out an in-depth review of the merits of the present zonal fares system and whether it would be better to replace it with a system which more closely reflects the costs of each individual journey made.

Peak and off-peak fares

10.68. At the moment the only differentiation between fares charged in the peak and off-peak is the non-availability of the one-day Travelcard until after the morning peak. But this Travelcard is valid during the evening peak.

10.69. We recommend that LUL needs to consider more carefully the relative cost of providing peak and off-peak services and whether fares are appropriately structured to reflect such cost differences. After due consideration and analysis LUL may wish to introduce a revised fares structure which takes into account more directly the relative costs of providing peak and off-peak services.

Travelcard and the evening peak

10.70. LUL does not consider that the effect of the promotion of the one-day Travelcard on the evening peak is at present a problem. In the past the main concern has been the morning rush-hour where demand has been more peaked. Demand at the evening and morning peaks, however, is now very similar. We are concerned that if Travelcard increases peak problems in the evening its pricing as an off-peak product may not be appropriate.

10.71. We conclude that LUL should look more closely at the effect of the one-day Travelcard on evening peak demand.

10.72. We recommend that LUL should undertake a review to assess the effect of Travelcard on demand during the evening peak within 18 months.

Pricing of Travelcard

10.73. LRT has pointed out that it is in the interests of London as a whole and its efficiency as a city that maximum use should be made of public as opposed to private transport. It believes that Travelcard helps achieve this. It also believes, however, that Travelcard is underpriced and it would like to raise the premium for Travelcards to a higher level compared with ordinary single tickets.

10.74. We would agree with LRT that Travelcard has an important role to play in encouraging the use of public transport in London. We therefore recommend that the Travelcard product should be retained. We would also agree that Travelcards appear to be underpriced and that there may therefore be a case for increasing their price relative to ordinary single tickets. We would, however, recommend that any decision to increase the relative price of Travelcards should be dependent upon the revised statement of LRT's fares policy (see paragraph 10.58) and should not be introduced until that statement has been agreed and published.

Allocation of Travelcard revenue

10.75. We note that LRT and BR have not been able to reach a mutually satisfactory agreement on the distribution of Travelcard revenue. We further note that as a result of this disagreement LRT has considered introducing its own LRT-only period season ticket which would provide a cheaper add-on to BR point-to-point season ticket holders from outside London.

10.76. We recommend that the two operators should continue their efforts to reach a mutually satisfactory agreement. If they cannot do so DTp should be prepared, if necessary, to determine what it considers to be a fair distribution of Travelcard revenue and instruct the two companies accordingly. We would not recommend that LRT should introduce its own ticket just because it could not reach agreement with BR on the distribution of Travelcard revenue between the two organisations.

Stored Value Ticketing

10.77. LRT is considering the possibility of introducing SVT. This would enable more flexible forms of pricing to be introduced. The financial justification of the investment required has yet to be proven. LUL is considering undertaking a limited trial in Zone 1 from which it would expect to have a better understanding of the costs and benefits.

10.78. We believe that provided a financial case for the necessary investment can be sustained, SVT could prove very beneficial in helping LUL to adjust its fares policy to reflect more closely the balance between supply and demand at different times of the day. We therefore recommend that LUL should be encouraged to examine further the potential for SVT.

11 Investment

Investment since 1979/80

11.1. Annual investment in the Underground was fairly stable between 1979/80 and 1984/85 at around £150 million, but it then increased throughout the following years to an estimated £391 million in 1990/91, as shown in Table 11.1 (all figures at 1990/91 prices). There were two main reasons for this increase: the increase in expenditure on safety following the fire at King's Cross in November 1987, and an increase in expenditure to maintain and improve the quality and capacity of the Underground system.

TABLE 11.1 **Investment in the Underground, 1979/80 to 1990/91, excluding ring-fenced expenditure**

£ million, 1990/91 prices

Year ended 31 March	*Renewal of infra-structure*	*New infra-structure*	*Total infra-structure*	*Rolling stock*	*Plant and machinery*	*Other*	*Total*
1979/80	38.3	28.0	66.3	55.5	5.5	21.3	148.6
1980/81	39.9	26.0	65.9	60.6	5.6	19.7	151.8
1981/82	46.6	17.6	64.2	42.7	9.8	33.0	149.7
1982/83	55.9	16.3	72.2	27.6	9.6	29.9	139.3
1983/84	65.7	19.9	85.6	26.1	10.6	44.3	166.6
1984/85	68.0	25.3	93.3	17.7	12.0	43.0	166.0
1985/86	84.9	38.6	123.5	12.5	9.1	37.3	182.4
1986/87	108.0	33.7	141.7	24.9	30.1	27.6	224.3
1987/88	85.6	76.6	162.2	23.4	8.5	65.5	259.6
1988/89	93.6	73.3	166.9	48.7	(5.0)*	42.5	253.1
1989/90	79.0	(12.3)*	66.7	77.6	94.5	99.2	338.0
1990/91 forecast out-turn	77.0	158.9	235.9	86.0	25.0	44.0	390.9

Source: MMC based on LUL information.

*Resulting from the final allocation for UTS there was an overall reallocation between new infrastructure renewals and plant and machinery.

Note: Prior to 1985/86 LUL's accounting year was the calendar year. Earlier years' figures have all been adjusted to financial years ending 31 March on a pro rata basis and so are imprecise.

11.2. The following analysis is based on expenditure on projects in the UIP, for which information is available from 1985/86 onwards as shown in Table 11.2. All the investment in LUL is carried out through these projects but project expenditure also includes some operating costs and other work, so figures differ from those shown in Table 11.1. Table 11.2 also provides reconciliation between the two figures.

TABLE 11.2 **LUL project expenditure, 1985/86 to 1990/91, with `fire safety' separately classified**

£ million, 1990 prices

	UIP, year ended 31 March						
	1985/86	*1986/87*	*1987/88*	*1988/89*	*1989/90*	*1990/91 forecast out-turn*	*Total*
Revenue collection	23.6	43.9	84.7	65.6	6.2	6.7	230.7
Track and structural renewals	38.1	34.5	26.4	32.9	50.1	48.4	230.4
Fire safety	0.0	0.0	0.0	18.9	62.2	139.6	220.7
Station enhancement and modernisation	46.2	47.3	40.6	24.3	13.3	7.3	179.0
Central Line renewal	5.9	7.9	4.8	3.3	63.9	66.2	152.0
Lifts and escalators	7.4	15.3	13.1	28.7	10.2	13.8	88.5
Power supply	10.3	16.5	19.9	15.0	16.6	8.1	86.4
Station capacity	0.0	0.0	2.9	2.5	36.1	35.6	77.1
Line resignalling	13.9	12.8	12.7	8.4	8.5	13.9	70.2
Service capacity and performance	0.0	11.1	17.4	27.3	2.0	1.1	58.9
Management systems	8.4	5.9	4.5	4.0	20.9	11.8	55.5
Staff accommodation and amenities	4.9	5.6	5.7	4.3	10.5	8.5	39.5
Rolling stock overhaul facilities	2.2	5.5	13.2	9.8	4.5	3.5	38.7
Underground communications systems	11.7	2.9	2.5	3.9	7.7	4.7	33.4
Passenger rolling stock	0.3	2.1	2.8	1.5	7.3	15.2	29.2
Other	24.1	37.3	31.3	20.6	37.2	39.5	190.0
Total project expenditure excluding ring-fenced expenditure	197.0	248.6	282.5	271.0	357.2	423.7	1,780.2
Less:							
Project operating expenditure	2.7	6.4	13.9	17.9	17.7	22.0	80.6
Work for outside parties	11.9	17.9	18.9	17.7	11.6	14.0	92.0
Plus:							
Third party funded assets	0.0	0.0	1.0	13.3	3.3	3.0	20.6
Property development and commercial expenditure*	0.0	0.0	8.9	4.4	6.8	0.0	20.1
Total investment (see Table 11.1)	182.4	224.3	259.6	253.1	338.0	390.9	1,648.3
Ring-fenced expenditure							
Jubilee Line						39.9	39.9
Other system extensions					5.0	6.4	11.4

Source: MMC based on LUL data.

*Property development expenditure, for 1990/91 (£7.1 million), is included in `other'.

11.3. LUL's expenditure on fire safety following the King's Cross fire increased from £18.9 million in 1988/89 to an estimated £139.6 million in 1990/91, as shown in Table 11.2. This expenditure accounted for 62 per cent of the increase in project expenditure of some £227 million between 1985/86 and 1990/91. A detailed description of the LUL safety programme is provided in Appendix 2.2.

11.4. Apart from expenditure on safety the largest increases were in the Central Line renewal, where annual expenditure increased between 1985/86 and 1990/91 by £60 million, and in station capacity, where annual expenditure increased by £36 million. The next largest increases related to passenger rolling stock, which increased by £15 million, and track and structural renewals, which increased by £10 million. These increases were partly counter-balanced by the completion of expenditure on UTS and a reduction in the level of station enhancement and modernisation because of funding constraints.

11.5. These investments both renew and enhance assets. There is no clear dividing line between renewal and enhancement. For example, the renewal of rolling stock and signalling provides an opportunity to introduce improvements which increase capacity and enhance the service, as is the case with the Central Line Project, where an estimated £467 million of the original authority was for replacement and renewal and £88 million was for enhancing the service (at mid-1989 prices). Other renewal work involves the track and structural renewals, station modernisation and enhancement, and lifts and escalators.

11.6. The sharp increase in demand on the Underground during the 1980s led to a number of reviews looking at the way capacity could be expanded and congestion reduced or avoided (see paragraphs 9.28 to 9.34). The main ways identified on the existing network whereby this could be achieved were:

(a) by increasing station capacity-mainly projects on station capacity shown in Table 11.2;

(b) increasing operational performance through work on bottle-necks such as resignalling critical junctions-mainly through service capacity and performance;

(c) line resignalling and the purchase of more trains-mainly through line resignalling and part of passenger rolling stock; and

(d) major work to increase capacity on the Northern Line, yet to be started.

11.7. In addition to the enhancement of capacity on the current network two studies, CLRS and ELRS, identified new lines and extensions to expand the rail network in London (see paragraphs 9.31 and 9.32). These are the Jubilee Line extension, East-West Crossrail and the Chelsea-Hackney Line. The only fully authorised project is the Jubilee Line extension, for which the funding is `ring-fenced' by DTp and, therefore, cannot be used to fund other LUL projects.

Future expenditure

11.8. At the time of our inquiry LUL was preparing the UIP for 1991. This had not been finalised but provisional figures are shown in Table 11.3.

TABLE 11.3 **Provisional 1991 UIP**

£ million, 1990/91 prices

	1991/92	*1992/93*	*1993/94*	*1994/95*	*1995/96*	*1996/97*	*Total*	*Previous six years 1985/86-1990/91*
Track and structural renewals	38.4	48.8	97.4	90.9	145.5	133.0	554.0	271.0
Central Line renewal	185.6	148.9	97.7	67.8	14.4	-	514.4	152.0
Passenger rolling stock	30.9	39.1	49.2	59.2	55.6	44.2	278.2	66.8
Station capacity	36.4	40.3	38.0	45.5	42.0	42.1	244.3	77.1
Line resignalling	10.9	9.2	18.8	29.7	29.4	28.2	126.2	72.2
Service capacity and performance	-	-	22.9	6.6	33.4	40.2	103.1	58.9
Power supplies	5.0	6.1	17.9	24.1	25.6	21.7	100.4	90.8
Station enhancement and modernisation	3.2	8.0	38.6	20.7	16.5	12.7	99.7	182.8
Section 12 works	23.1	34.0	11.9	20.3	-	-	89.3	105.8
Depot modernisation	3.3	5.0	22.8	16.6	26.6	14.1	88.4	23.5
Northern Line development	-	-	1.9	8.8	25.0	35.2	70.9	3.5
Station operation enhancement	3.5	14.9	14.6	9.9	10.2	13.9	67.0	5.2
Management systems	2.2	0.1	9.4	12.0	18.5	18.5	60.7	55.6
Staff accommodation and amenities	1.5	0.4	20.7	14.3	10.6	8.7	56.2	39.6
Underground Communication System	1.6	3.6	14.1	14.6	4.6	4.6	43.1	33.4
Revenue collection (UTS)	2.4	0.5	9.6	18.0	3.0	2.9	36.4	230.7
Property development schemes	7.5	7.6	6.8	4.3	3.0	2.9	32.1	12.2
Lifts and escalators	10.8	5.1	3.5	1.3	5.4	5.6	31.7	81.1
Retail premises improvement	-	-	5.5	5.1	8.8	8.8	28.2	0.7
Other	10.5	6.5	19.3	10.4	12.5	10.5	69.7	217.3
Contingency	6.9	-	-	-	53.6	89.1	149.6	-
Total project expenditure, excluding ring-fenced expenditure	383.7	378.1	520.6	480.1	544.2	536.9	2,843.6	1,780.2
Ring-fenced expenditure								
Jubilee Line extension	157.4	391.0	391.2	259.3	108.0	18.0	1,324.9	39.9
Other system extension	22.1	125.7	310.1	580.7	710.6	1,913.6	3,662.4	11.4

Source: MMC based on LUL data.

11.9. Over the six years 1991/92 to 1996/97 project expenditure is projected to be £2,844 million, compared with £1,780 million over the previous six years, excluding ring-fenced expenditure in both cases. The largest increases in expenditure compared with the previous six years are in the Central Line renewal, track and structural renewals, passenger rolling stock and station capacity. Over half of the track and structural renewal expenditure has been delayed until the last two years of the period. LUL is planning an increase in project expenditure from £384 million in 1991/92 to £537 million in 1996/97.

Aims of the UIP

11.10. Under the LRT Act, LRT has `a duty to provide or secure public passenger transport services for Greater London, having regard to efficiency, economy and safety of operation'. In a letter to LRT of 22 March 1989, the Secretary of State set out priorities for LRT of which three in particular related to LUL:

(a) implement the recommendations of the Fennell Inquiry into the King's Cross fire;

(b) provide for the projected increase in traffic; and

(c) improve the quality of service and security.

The need to maintain or secure LUL's current service efficiently, undertake safety work, increase the capacity on the system and improve the quality of service are all reflected in the investment priorities that were developed by LUL during 1990. LUL told us that prior to 1990 it had not developed such a formal prioritisation procedure because the funding constraints were not so apparent; nor had such a significant proportion of projects been safety-related. However, on social cost benefit analysis the project approval process had been no less rigorous.

11.11. LUL has developed a list of 17 priorities:

A Safety: statutory;
B Safety: identified major hazard;
C Asset health: unsafe equipment;
D Management initiatives (includes some station modernisation);
E Investment in staff (mainly staff accommodation);
F Asset health: life-expired equipment (including the Central Line renewal);
G Asset health: other;
H Revenue protection and collection (UTS);
I Efficiency improvements;
J Passenger security and crime prevention;
K Service performance improvements;
L Traffic revenue generation;
M General safety improvements;
N Visual enhancements;
O Other passenger benefits;
P Secondary income generation; and
Q Congestion relief.

In broad terms the priorities can be categorised as (priority letters shown in brackets):

1. Safety and security (A, B, C, J and M).

2. Asset health, that is projects necessary to maintain LUL's service, and other investment necessary for the management and running of the business (C, E, F and G).

3. Projects central to the business which are justified because they reduce costs or increase revenue (D, H, I, K and L).

4. Projects justified on their passenger or wider benefits or projects which are not central to the business (N, O, P and Q).

Projects which increase the capacity or quality of the Underground would normally be justified under the third or fourth category and so will have a lower priority than safety or maintaining the current system. More worthwhile projects in lower priority categories, however, may be given precedence over projects in the higher priority categories, as described in paragraph 11.23.

11.12. The importance placed on expenditure on renewals reflects a long period of underinvestment and insufficient maintenance expenditure over many years. In particular LUL has told us that the infrastructure, including the permanent way, tunnels, bridges, stations and platforms and drainage, need major expenditure if they are to remain safe and be brought up to reasonable standards. LUL estimates that, given a properly maintained asset base, it would need to spend £250 million a year replacing equipment. It estimates, however, that to deal with the accumulated backlog of replacement expenditure and to return the assets to a satisfactory condition would require an additional expenditure of £300 million each year for ten years. Furthermore, it estimates that it would need a further £150 million each year to the end of the decade to provide an acceptably modern metro.

11.13. LUL introduced a new computer system in 1989 for project control, the Investment Planning Control System (IPCS). Part of this is used, among other things, for preparing the investment plans and budgets, and provides help in ranking projects. It has also been designed to hold information on the benefits of a project. A complementary module to IPCS, Track 9000, is used in project management and is described in paragraphs 12.20 to 12.27.

11.14. At present LUL does not list projects by cost benefit ratios or their commercial returns, although this is planned to be included in IPCS. Consequently, it is not clear how far the priorities reflect the costs and benefits. LUL has told us that, although in theory cost benefit ratios provide a basis for setting priorities between projects, there are a number of problems with their use given the likely funding difficulties over the next two years:

(a) they do not reflect the funding constraints which mean that some large projects, although well justified, cannot be afforded within the short term;

(b) within the funding constraints LUL considers that it is better to have projects which cover their costs and generate additional revenue or cost saving in a short time in order to provide income to help pay for other projects in future years; and

(c) it is difficult to measure the benefits of some projects, such as staff accommodation, and a judgment needs to be made about the priority these should take.

Nevertheless, LUL told us that it recognises that cost benefit ratios are one means of assisting in making decisions on priorities and that it will examine ways of using them more systematically in the future.

11.15. There are problems in looking back at how well LUL achieved its investment targets. In the past the budget has been analysed by objective but LUL has not measured actual project expenditure against the objectives set in the UIP. Out-turn has been monitored, however, at both project level and at Major Project/Strategic Initiative Group level. In consequence, there is no information at an aggregated level on how well objectives have been achieved and what the associated benefits were. IPCS will allow LUL to show both the financial effects of projects and the passenger benefits associated with them. LUL intends to use this information to derive operating budgets which reflect the benefits that should be realised from the projects and it plans to show budget investment against out-turn analysed by the new classification of objectives in future years.

Development of projects for the UIP

11.16. Each year LUL prepares a UIP for the next ten years. This sets the budget for the first year and provides a projection of expenditure for each of the next five years and in total for the last four years.

11.17. Projects for the UIP are mainly developed within the Development and Engineering Directorates although the LGMs are becoming more involved in the process. The Development Directorate accounted for around two-thirds of project expenditure in 1990/91. The impetus to develop new projects comes from a variety of factors, including the need to maintain and replace equipment, various external or joint reviews such as CLRS and internal studies.

11.18. An important new impetus for projects has come from LUL's Business Goal 4, `asset maintenance and renewal so that the system works well and looks good'. LUL has defined `works well and looks good' as `the standard equivalent to the fully refurbished train'. LUL intends to develop a five-year programme covering track, signalling, escalators, stations and trains. A memorandum from the Managing Director of LUL of July 1990 sets out the basis for arriving at this programme including:

(a) defining appropriate engineering standards;

(b) listing and describing current assets and the work needed to achieve the goal;

(c) costing the maintenance, renewal and betterment components separately;

(d) assessing the feasibility of meeting the targets with the skills available, industry capacity etc; and

(e) estimating the annual maintenance costs over the succeeding five years.

11.19. Projects considered worthwhile are developed by directorates. They are approved if they are justified within the LUL appraisal criteria (see paragraphs 11.30 to 11.39) and fit in with the Business Goals. Approval of a project does not guarantee that funding will be available for it. LUL told us that it did not consider that it was appropriate for projects to be developed within departmental budgets because such a process could lead to the inclusion of certain projects at the expense of other more worthwhile projects. The purpose of developing the UIP was twofold:

(a) firstly to provide a measure of work needed to realise the Business Goals which would form the basis of the negotiation, through LRT, with DTp for the amount of funding; and

(b) secondly to provide information necessary to allocate the funds available.

LUL considers that the effective method of allocating the available funds is to set priorities against which projects may be ranked rather than restrict the funding available to each project. However, when the final authority for a project is sought this involves the consideration of alternative options. In the past LUL has not normally presented different options with different funding constraints, except for a limited number of projects, and has not normally looked at the funding implications of delaying projects. LUL accepts that it needs to do more and, in some areas, it is constructing models to address the effects of trade-offs between renewals, replacements and maintenance.

Method of arriving at the UIP

11.20. The final UIP is based on the level of funding which is expected to be available internally and from LUL's allocation from LRT's EFL, which is provided by the Government. Each year LUL is given a guideline level of funding by LRT and the directors responsible for developing projects are asked to put in a bid for projects they wish to be funded in the next year, based on LUL's ten-year plan.

11.21. LUL also undertakes projects which involve funding from external parties. Such projects arise as follows:

(a) Improvements/alterations to LUL's assets which LUL would undertake anyway but to which an external party is willing to contribute (eg modernisation/extension of booking halls when a property development is taking place above or adjacent to them).

(b) Work requested by external parties which LUL would not otherwise undertake, either:

(i) on external parties' assets over, under, or adjacent to, the railway; but which for safety/security reasons LUL will undertake, with full reimbursement of cost (eg new road bridge over the railway for DTp); or

(ii) on existing LUL assets or creating new LUL assets, again fully at the external parties' cost (eg additional station entrance from a new development not warranted on LUL commercial grounds).

LUL has undertaken other initiatives to secure third-party funding, of which recent examples are power generation and the Jubilee Line extension. In the case of power generation LUL is involved in a joint venture which will provide private funds to replace the plant at LUL's Lots Road and Greenwich power stations. These will be leased to the joint venture company, from which LUL may buy power as it requires.

11.22. The UIP serves both as a means of identifying all the projects that LUL considers worthwhile and as a means of planning actual expenditure on projects. To be included in the UIP a project needs to have gained preliminary approval from LUL's Investment sub-committee if it is estimated to cost over £250,000. If a project cannot gain a high enough priority for an early start even though its meets the investment criteria, it normally stays in the UIP but is deferred to a later date. LUL tends to put projects into the UIP in the earliest practical year and then move them back if funding is insufficient. This can result in a `bow wave' as projects are pushed to future years (see paragraph 11.25). LUL is developing a new process to produce the UIP. This provides three scenarios: guideline funding provided by LRT taking account of the Treasury Guidelines for future funding; essential expenditure; and desirable levels of expenditure. In addition, the prioritisation categories now attached to all investment proposals should provide a means of adding or omitting projects if funding is made available at a different level from that expected.

11.23. Bids in 1990 and 1991 exceeded the funding available and projects had to be cut or postponed. For the 1990 UIP LUL's Managing Director classified the UIP objectives into nine areas in order of priority as a basis for reducing the bids. These priorities were refined further during 1990 to make them clearer and more focused. LUL developed a list of 17 categories from A to Q in order of priority, as described in paragraph 11.11. Within each area projects were classified into six groups, for example A1 to A6, from the most to the least worthwhile. The intention was that A1 projects would have priority over B1 projects but B1 projects may have precedence over less worthwhile A projects. A consensus was then sought among LUL directors about the exact ordering of priorities, leading to priority ranking from 1 to 102 (17 x 6).

11.24. Table 11.4 compares the UIP for 1989, 1990 and 1991. Planned expenditure for 1990/91 in the 1989 UIP was £601 million. These plans were cut back in the 1990 UIP to £515 million to match the anticipated funding. The largest cuts were made by reducing expenditure on additional UTS gates outside Zone 1, deferring expenditure on increasing station capacity, deferring expenditure to increase service capacity and performance and deferring expenditure on the Northern Line renewal. Apart from the UTS gates, these were all areas aimed at increasing the capacity of the Underground over which investment in safety and maintaining the current system took priority.

TABLE 11.4 **Comparison of the 1989 and 1990 UIP and Business Plan with the provisional 1991 UIP (figures exclude ring-fenced expenditure)**

£ million, September 1990 prices

	1990/91	*1991/92*	*1992/93*	*1993/94*	*1994/95*	*1995/96*
All projects						
1989 UIP	601	549	599	546	466	-
1990 UIP	515	803	836	807	615	504
1991 UIP	-	384	378	521	480	544
Change since previous year	(86)	(419)	(458)	(286)	(135)	40
Committed + essential projects						
1989 UIP	334	271	337	310	285	-
1990 UIP	343	463	480	468	373	394
All projects in the 1991 UIP compared with the 1990 committed + essential	-	(79)	(102)	53	107	150

Source: MMC based on LUL information.

11.25. The 1990 UIP projected very high expenditure in 1991/92 to 1993/94 of over £800 million a year. This reflected both the moving forward of projects from 1990 to later years and new areas of expenditure including a large increase in rolling stock refurbishment and the accelerated replacement programme for the Northern Line rolling stock. The 1990 UIP's projected expenditure in 1991/92 was £803 million compared with the amount which is now budgeted of £384 million within the 1991 UIP. Table 11.5 shows the reasons for the reduction of £419 million. The first column of the table shows the figures in the 1990 UIP for 1991/92 at 1990/91 prices. At that time LUL assumed inflation would be 7 per cent between 1989/90 and 1990/91 but it now estimates that it will be 10 per cent. The second column shows the figures assuming 10 per cent inflation, consistent with Table 11.4. Going down the table, comparing columns two and three, the 1990 UIP had planned for a net slippage in project expenditure of £111 million. This slippage reflected an assumption that the planned increase in project expenditure in 1991/92 compared with 1990/91 would not in practice all be spent in that year. LUL has since dropped the allowance for slippage. Under the 1990 UIP the slippage was still planned but would have fallen into the following year, when it would then have had to be funded. The next item shows that the project expenditure paid for by outside bodies fell by £14 million compared with that originally planned. This has no effect on the available funds for other projects. The reduction in internal resources mainly reflects the fact that LUL had planned to increase fares by 3 per cent more than was finally realised, so reducing available funds by £25 million. This was partly compensated for by an expected reduction in operating costs. The reduction in LRT's allocation to LUL of Government funding reflects the difference between the 1990 guideline figure for 1991/92 supplied by LRT to LUL and the actual funding LRT is able to provide given the final EFL and the requirements of other parts of LRT. Finally the 1990 UIP had planned for £220 million project expenditure additional to funding that was identifiable at that time. No funding is available for this.

TABLE 11.5 **Project expenditure in 1991/92 in the provisional 1991 UIP compared with that planned in the 1990 UIP**

1990/91 prices

	(1) 1990 UIP assuming 7% inflation		*(2) 1990 UIP revised to expected 10% inflation*		*(3) 1991 UIP*		*(3)-(2) Change*	
Total project expenditure for 1991/92		781		803		384		(419)
Less:								
Slippage	108		111		-		(111)	
Externally-funded projects and work for outside parties	33		34		20		(14)	
Internal resource	111		114		91		(23)	
Cash funding based on Government guidelines	324		324*		273†		(51)	
		576		583		384		(199)
Additional funding requirement to meet the investment plan		205		220		-		(220)

Source: MMC based on LUL data.

*This is a cash guideline and is therefore not affected by the level of inflation.
†Deflated to 1990/91 prices using the LUL assumption of 8 per cent inflation between 1990/91 and 1991/92.

11.26. The reductions in investment in 1991/92 were negotiated through a committee headed by LUL's Engineering Director and used the detailed priorities developed by LUL, although further judgmental changes were made to arrive at the projects that went into the UIP. Following this procedure LUL commissioned an internal report by its non-executive director with special responsibility for safety, Mr Vogel, to look at the effects of the cuts on safety. The `Vogel report' said that `the process of compiling the 1991/92 capital budget started well with a high degree of involvement … However, as the extent of the adverse financial situation grew the process became blurred. This has degenerated to the point where our "standard setters" do not know what is yet included or excluded in the budget. There is a strong belief that some excluded projects must go ahead.' As a result of this report the LUL Board immediately instigated changes in the UIP.

The effects of the cuts

11.27. To help it in prioritising LUL classifies its future investment projects into those which have been committed, those which are essential and those which are discretionary. A more comprehensive definition of both committed and essential expenditure has recently been developed. The 1990 UIP projected the committed and essential projects for 1991 to be £463 million, as shown in Table 11.4, although funding is now available for only £363 million of these. LUL has doubts whether sufficient funding will be available in 1992/93 for all the essential plus committed projects identified.

11.28. LUL told us that it had not yet assessed in detail what the final effect of the reduction in the UIP would be. It was, however, concerned that the safety of the Underground at some points may fall below acceptable levels in 1992/93. Also it did not consider that there would be adequate funding to maintain the system. Consequently it would not be able to achieve its quality of service targets and the quality of service was likely to deteriorate.

11.29. One effect of the cuts is that projects which are not essential but which have a commercial payback of, for example, between one and two years are not being included in the UIP.

Project appraisal

11.30. Before expenditure on a project is finally authorised a full appraisal is required. The level of authorisation depends on the size of the project: projects over £2 million require authorisation by the LUL Board, those over £5 million require further authorisation by the LRT Executive Committee and those over £10 million require the approval of the LRT Board. A list of projects costing over £2 million is also sent to DTp, which may call in any of these projects for approval, although its approval is more likely to be required for the projects of £10 million and above.

11.31. The project appraisal criteria are agreed between LRT and DTp and are used by LUL. A detailed description of the criteria is provided in Appendix 11.1. Within LUL, project appraisal is supervised by the Investment Controller's section, which checks and provides a financial commentary and appraisal for all projects greater than £250,000 and also provides advice and help as needed. LRT also has a project appraisal section but the review and appraisal of LUL projects has been devolved to LUL; however, LRT will consider appraisal options on projects submitted for approval to the LRT Board.

11.32. LUL's Finance Directorate provides a Client Manual on appraisals and the planning, budgeting and approval process and a more detailed manual is available within the Development Directorate, which is responsible for the majority of projects. The Client Manual does not provide as detailed advice on project appraisal as that in the Development Directorate's Project Appraisal Standards Manual, nor does it provide information on the lessons learned from previous projects.

11.33. The appraisal criteria used by LUL are:

Type of project	*Appraisal criteria*
Cost saving projects (no effect on service level)	Financial costs more than paid for by the financial savings.
Projects needed to maintain service at current levels	Cost-effectiveness where the need for service is unquestioned.
Reduction in service level	Cost benefit criteria: the ratio of net `financial savings' to the loss to passengers (and wider effects) is 1:1.3 or greater.
Increase in service level	Cost benefit criteria: benefits to passengers (and wider effects) exceed the net `financial costs' by 1.3:1.
Improvement in safety	LUL is developing criteria for assessing safety projects (see paragraph 11.39).

More projects meet the criteria than LUL has the funds to carry out.

11.34. Projects may cut across a number of the above criteria. For example, where new technology is used to maintain the current services it may enable improvements in the service level. Projects which both replace and enhance assets required for the continued running of services are assessed in two stages by LUL. First, it estimates what the cost would be of replacing the assets at the end of their lives with modern equivalent assets. Secondly, it evaluates the benefits of enhancing the assets in order to improve the service. In the case of the Northern Line the modern equivalent asset will be the trains to be introduced on the Central Line, which would provide an enhanced service compared with the trains currently running on the line. LUL told us that the use of modern equivalent assets was to a certain extent arbitrary but that it considered that this was the best approach. DTp's investment appraisal guidelines recognise modern equivalent assets as one possible base case, defining modern equivalent assets as the minimum full-life cost replacement of existing levels of capacity.

11.35. All appraisals use net present value: future costs and benefits are discounted back at 8 per cent real.

11.36. For cost benefit appraisal where the service level is affected LUL does not look just at the financial effect on its own services. Under the new DTp guidelines LUL excludes from its revenue receipts

any revenue gained from passengers transferring from bus to Underground less any consequential cost saving. In the past LUL had also excluded revenue gained from passengers transferring from BR services. This procedure was followed in the case studies we looked at (see paragraphs 11.64 and 11.74).

11.37. The benefits to passengers of an improvement in the service, under the new DTp guidelines, are valued at the amount passengers would be willing to pay for these improvements.

11.38. Where the benefits to passengers are not enough to justify a project, or where projects have significant external effects, LUL also looks at the wider effects of the project, including the effects on all other transport users and on road congestion. In practice most projects are appraised only on their direct financial effects and the benefits to LUL passengers. The wider effects were, however, taken into account in assessing certain major projects, including new lines and the Central Line renewal. As a result the cost benefit ratios for these lines cannot be directly compared with projects which do not take account of the wider effects.

11.39. LUL is presently developing ways of assessing safety projects through the use of risk assessment. This involves `fault trees' which identify faults which in combination could lead to an accident. The frequency of such faults can then be assessed to determine the likelihood of any incidents which would endanger passenger or staff safety and their probable severity. LUL intends to evaluate the most effective way of reducing the chance of an accident for a given level of safety investment and to develop a cost benefit assessment of safety projects to be used to help select projects and set priorities. However, it sees considerable problems in gaining official and public acceptance of a cost benefit assessment of safety expenditure based on hazard analysis as this would involve judgment about the value of human life. LUL intends to take safety standards into account in arriving at engineering standards on the Underground and to build safety standards into the engineering design practices.

The link between investment, fares and quality of service

11.40. It is current DTp policy that LRT should transfer some of the burden of financing the Underground from the taxpayer to the users of the system. DTp's project appraisal guidelines say that where passengers are willing to pay for passenger benefits resulting from improvement in service the calculation should be carried out as if fares were increased to match the benefit. This leaves open the question of how these passenger benefits should be financed. In practice it is very difficult with the present fares structure to increase fares in any section of the Underground to reflect an improvement in that section, but we have been told by LUL that an improvement in services in the central area, for example, could be reflected in the price of travel in Zone 1. In the past LUL has not produced information on the overall effect of the investment programme in improving services: for example, from aggregating the passenger benefits associated with each investment. However, it has agreed with DTp that this information will be recorded in the future.

11.41. The effect of different levels of investment on LUL's ability to achieve its quality of service targets is not quantified centrally but LUL told us that its LGMs have a good idea of the effect of the UIP on their ability to achieve their quality of service targets. LUL is currently working on a planning model which it hopes to use to identify how investment feeds through to the operating performance of the system.

Synergies

11.42. Synergies between parts of the Underground system are important in determining and justifying some investments. In particular LUL told us that there are large benefits to be gained in bringing new rolling stock on to a line at the same time as introducing new signalling, to enable new technology to be used. Prior to 1991 the formal method of setting priorities within the UIP did not take account of synergies between projects, with the exception of major projects such as the Central Line and Northern Line, which were developed to achieve such benefits.

11.43. LUL also intends to develop `work packages' which bring together projects that it would be advantageous to carry out together. For example, during the closure of a station it is sensible to carry out all work on the station at the same time. A part of a work package may have a low priority whilst standing alone, but cost reductions which may be achieved from carrying out the work in parallel with other elements of the work package may significantly improve the benefit cost ratio, such that LUL would consider raising it within the priorities.

11.44. For the 1991 UIP instructions were sent to clients on the development of work packages. With funding so tight, however, work has concentrated on how to defer lower priority projects, which would otherwise have been done in conjunction with a higher priority project, to produce a UIP which fits within the EFL guidelines. Synergies are currently taken into account by each client for projects within his or her area and through negotiation between clients for projects where it would be sensible to carry out work in a co-ordinated way.

11.45. On a practical level co-ordination is important between projects affecting the same assets. In the last year LUL has developed a station-planning approach which co-ordinates all the work on an individual station. Co-ordination can, however, be frustrated when urgent new requirements arise, such as the Fennell recommendations and section 12 requirements.

Renewal and replacement investment

11.46. A large part of the UIP consists of renewing and replacing equipment and infrastructure. In the past LUL has based its renewal policy on engineering judgment. LUL is now developing the necessary information and analytical tools to enable it to base decisions regarding the maintenance and renewal of assets on whole-life costing, taking account of the effect on revenue, services and passenger benefits. The LUL Board has asked for investment and renewals strategies to be reviewed, recognising that current strategies may be out of date. LUL has prepared a `framework for an investment strategy' to be followed in these reviews. This takes full account of whole-life costs. The pumps and drains strategic initiative has been developed using this new framework.

Permanent way

11.47. The maintenance condition of the permanent way affects the quality of ride, maximum safe speed of trains, reliability of the service and maintenance cost of the rolling stock. In the past LUL had only simplistic processes for assessing the cost and benefit to it of increasing investment in the permanent way. LUL is currently working with BR Research to adapt its computer-based renewals and maintenance planning system (MARPAS) for use by LUL. This advanced planning aid will provide the basis for a much more comprehensive review of the many complex factors involved in optimisation of track quality management.

11.48. We were told that the lack of information on the costs and benefits of repair and replacement of the track and ballast in the past had made it difficult to justify investment in the permanent way. LUL is currently developing a track quality improvement plan which is likely to require major investment and will, therefore, be the subject of a full cost benefit appraisal. Technical proposals for the improvement plan are well advanced and work is now proceeding on the establishment of an implementation plan, which will also address other related issues, such as track access times for the proposed improvement works.

Signalling

11.49. Potential investments in signalling are identified in a number of ways:

- from analysis of bottle-necks and the benefits that could be gained from dealing with these;
- from major studies such as the Jubilee Line extension;
- because the equipment is reaching the end of its life;
- from problems with the signalling, identified by LGMs; and
- from evaluation of new signalling systems which may justify early replacement of signalling.

11.50. The `traditional' signalling on the Underground is designed to have a 40-year life. As far as possible renewal is planned over a 40-year cycle to avoid peaks in spending. The moving parts of the signalling systems used to be replaced on a five-year cycle but this was extended to seven years following a review of failure rates.

11.51. Up to two years ago the need to replace or repair equipment was based on the experience and judgment of the engineers. Work is now in hand to provide a more detailed analysis of failures. LUL is establishing an asset register which will allow the failure of equipment to be matched against the assets involved. LUL has acquired a system called TIMS (Technical Information Management Systems) to analyse the failure information.

11.52. It is now possible to provide computer-based signalling, with computers on the trains and lines, which will enable the service to be improved. LUL is carrying out studies on such `transmission-based signalling' (otherwise known as moving-block signalling). We were told that the benefits from the introduction of this type of signalling may justify replacement of existing signalling systems earlier than at 40 years.

Rolling stock

11.53. In the past trains were replaced when they were in such a poor state or so obsolete that it was difficult to keep them reliable or safe. Problems with the basic structure of the trains tended to occur after 40 years and LUL has specified the design life of trains as 35 to 40 years. LUL carried out a review in 1985 which showed that in general it was cost-effective to replace trains in this time-scale.

11.54. LUL's assessment of replacing the rolling stock on the Northern Line showed that there could be considerable benefits from advancing the replacement of the rolling stock before the time identified in the 1985 review because this would allow an improvement to the service. LUL is carrying out another review of its rolling stock replacement programme.

Line and station closure

11.55. The cost of carrying out work on the Underground is considerably higher when work is restricted to the short period when the system is closed. This can be as little as 2½ hours, between 1.30 am and 4.00 am. In the past LUL has used weekend and temporary station closures to carry out major works but until recently it has not considered medium-term temporary closures of sections of line. Each closure is now assessed on the basis of a cost benefit assessment and takes account of the concerns of the users and of other people affected. Up to now consideration of line closures has been limited to the outer areas.

11.56. LUL is currently reviewing the scheduling of its last and first trains to look at the feasibility of reducing the length of the operating day; it will also be considering the provision of alternative bus services. We have been told that LUL needs to increase access time at night if it is to carry out its intended programme of track renewals. There will also be cost savings from increasing access time at night. LUL estimates that the costs of running trains for the last half-hour at night exceed the revenue and that an increase in access at night of half an hour would improve productivity on work on the permanent way by 20 per cent. The first half-hour of the service in the morning is calculated to generate enough revenue to cover the costs and in some cases it might not be possible to start later in view of the time needed to build up the service for the morning peak.

Post-investment appraisal

11.57. Post-investment appraisal has only been undertaken in a limited way in the past and has tended to concentrate on problem or large projects, although at the closure of all projects the benefits achieved or expected have to be approved by the original authorising body. In 1990 half a dozen such appraisals were

undertaken by LUL and two or three by LRT, compared with around 200 projects costing over £250,000. In 1991 there is a plan to do three per quarter not counting projects with problems and any carried out by LRT. The appraisals will include both good and bad projects. IPCS will allow more analysis of benefits and costs realised compared with the original proposals.

Case studies of investment appraisals

11.58. We carried out a number of case studies of investment appraisals. We describe here the appraisal of the Central and Northern Line renewals.

Central Line

Background

11.59. The Central Line Project involves the resignalling of the line and the introduction of new rolling stock. The timing of the project was dictated by the engineering view of the life of the signalling, which was installed from 1940. It was the view of the engineers that this would be reaching the end of its life at between 40 and 50 years and that it would be unsafe to extend the life beyond this. The signalling was therefore due for replacement from 1990. The Central Line rolling stock dates from 1962 and the Rolling Stock Working Party recommended in 1985/86 that this should be replaced between 1997 and 2002. LUL, however, saw considerable advantages from replacing the rolling stock and signalling at the same time. This was because:

(a) it would avoid the additional investment which would be required to run old trains with new signalling;

(b) the design of the signalling could be carried out to match the performance capability of the new trains; and, most importantly

(c) a system of automatic train control could be introduced without the considerable technical problems which postponement of the introduction of new trains would cause.

It was, therefore, considered better to replace the rolling stock early, leaving the similar though somewhat older stock on the Northern Line to be replaced at a later date.

11.60. The renewal of the Central Line involved an enhancement of the capacity on that line, increasing the peak capacity from the current actual performance of 27/28 TPH to 33 TPH.

Main options considered

11.61. The original brief for the project did not cover major track and depot renewals, in part because there was not enough information on the costs and benefits of including them and also because there were separate programmes for these. LUL now considers that the state of the track justifies major replacement not only because of the ride quality and speed restrictions but also because it increases the wear and tear on the trains. The present funding restrictions, however, are delaying this replacement. Other possible options included extending the life of the existing rolling stock beyond its 35-year life. Some work was done on the feasibility of extending the life of the trains but LUL considered that the costs and difficulties associated with this made it an uneconomic option. There was no formal assessment of this option in the evaluation of the scheme.

11.62. The technical choices available for the Central Line were considered by working groups including members from LRT and DTp. The final project plan which went to the LUL Board and subsequently LRT and DTp was a justification for the preferred option over the modern equivalent asset option.

Evaluation of options

11.63. In evaluating the Central Line renewal the base case was taken as maintaining the service at its current level. This was based on the cost of replacing the signalling and rolling stock at the end of their respective lives with modern equivalent assets. The definition of modern equivalent assets was agreed with DTp. This base case was assumed to be the minimum that LUL could do to meet its obligations. The benefits and costs of the preferred option were then taken as the additional benefits and costs of the preferred option compared with the base case.

11.64. Table 11.6 shows the 1988 net present value of the overall financial effects of the enhanced option over the base case, taking account of all changes in LUL costs and revenues, but excluding revenue gained from passengers transferring from bus or BR. These effects do not include any additional revenue that may be collected from existing passengers through higher fares. The net present value of the overall financial effects is compared with the passenger benefits from the improved service to give a benefit to cost ratio. The project involved integrated planning and design but LUL showed the different parts of the scheme separately to try to identify the benefits associated with each. Of note are the `train features' which show that LUL was able to reduce the cost of the train over the assumed modern equivalent asset. The `automatic train control and the cost of advancing the replacement of the trains' represents the benefits which arise from replacing the rolling stock before 1997 to enable automatic train control to be introduced. The main part of this cost was £14 million to advance the rolling stock replacement from its assumed end of life. Table 11.6 also shows the financial effect on LUL alone.

TABLE 11.6 **Central Line, 1988 net present value of the enhancement**

	Effect on LUL's finances £*m*	*Overall financial effect** £*m*	*Passenger benefits* £*m*	*Benefit to cost ratio*
Centralised control of signalling	7.70	(2.66)	27.93	10.5:1
CCTV in the train cab	1.15	(0.39)	4.08	10.5:1
Train features	11.83	4.53	19.03	†
High performance of the trains including enhancing the power supply	(0.20)	(8.91)	22.15	2.5:1
Work on the permanent way and other improvements to the infrastructure	5.13	(0.68)	12.17	17.9:1
Train length	4.32	1.12	8.10	*
Automatic train control and the cost of advancing the replacement of the trains	7.62	(20.90)	73.8	3.5:1
Peak direction services	1.35	(2.77)	10.83	3.9:1
Increase in capacity through additional trains and signalling	2.80	(7.24)	31.03	4.3:1
Total	41.70	(37.90)	209.12	

Source: MMC based on LUL information.

*For the method of calculating this see paragraph 11.64.
†Not applicable.

Sensitivity analysis

11.65. The sensitivity testing of the project involved reassessing the benefits first with an assumed lower demand, which assumed no increase in demand between 1987 and 1996. Separately from this the effect of higher costs was looked at, using the main demand projections. LUL considered that most of the costs had a tolerance of 35 per cent. The project was robust to these changes; only two elements of the `work on the permanent way and other improvements to the infrastructure' became marginal with lower demand or higher costs.

Northern Line

Background

11.66. The 1985 Rolling Stock Working Party recommended the replacement of the Northern Line rolling stock between 1991 and 1995. This was delayed to allow the signalling and rolling stock in the Central Line renewal to be replaced simultaneously. The planned renewal of the Northern Line was put back to 1997 but no firm date has yet been set. The option exists to transfer Central Line trains, after minor modification, on to the Northern Line but this is not currently planned. Work to increase capacity on the Northern Line was identified in CLRS as an important part of the major upgrading programme for the current Underground system.

11.67. The brief for the Northern Line Project was to look at the best way of upgrading the line. There was no specified budget limit at the time; there was the belief that the funding would be available for a justified project. The initial scope of the project was confined to rolling stock and signalling. The estimated cost of the project was around £400 million in 1990/91 prices.

11.68. The first stage of the assessment was to gain agreement from the LUL Board to go ahead with planning which would allow for potential implementation from 1994 onwards. This was sought on the basis of a paper which went to the LUL Board in September 1989 and showed that benefits from introducing rolling stock from 1994 rather than from 1997 exceeded costs. The paper only looked at the benefits of advancing the rolling stock with no change in signalling, although the project was intended to replace the signalling and rolling stock at the same time. There was no assessment of what expenditure might have to be undertaken if the project was delayed as there was optimism that it would be approved and implemented on time. Because of the postponement of the project the costs of delay are now being looked at.

The main options considered

11.69. To look at the effects on service of different designs a performance specification has been developed for the Northern Line trains with the help of TSM. Based on this specification there would be a competition for the design of trains. The option of using the new-design Central Line trains was considered but the smaller bore on the Central Line and the shorter length of the trains did not make this option appear worthwhile.

11.70. LUL is considering the cost and benefits of using moving-block signalling (see paragraph 11.52). This provides a more flexible method of signalling which reduces the headway between trains. With moving-block signalling the existing signalling constraints on the capacity of the system are significantly reduced.

11.71. The project did not consider refurbishing the old stock as this had already been found not to be cost-effective. One option, which was the main option mentioned in CLRS, was to split the line at Camden, giving two completely separate lines running north from Kennington. This would involve investment at Camden Town to allow passengers to transfer. It is now thought that the problems of a bottle-neck at Camden Town can be overcome by using a new signalling system. Before any final decision, however, the option of splitting the line will be considered.

11.72. The project did not include renewal of the stations or permanent way. Consideration of the option to include the renewal of the permanent way was included in the project at a later date but has not yet been appraised.

11.73. The main analysis up to now has concerned the costs of earlier replacement of trains and signalling. Other issues are service level, train design, whether there should be smaller wheels and train length.

Appraisal of the benefits

11.74. As was the case with the Central Line the evaluation of the project was to be based on a comparison of the preferred scheme with modern equivalent assets. The intention was to carry out a full appraisal by mid-1991 but because of the postponement of the project this has not been done. The outline assessment of the benefits of advancing the replacement of the rolling stock was based on a comparison of the cost of replacing the rolling stock three years before it was planned with the benefits from this advancement. The net present cost of advancing the replacement was the difference between the net present value of replacing the trains from 1997 and that of replacing them from 1994. A comparison was also undertaken to look at the cost and benefits of delaying the replacement by three years. The net present cost of advancing the replacement of the trains was estimated as £23.1 million, including the additional revenue to LUL but excluding revenue from passengers transferring from BR and buses to LUL. The passenger benefits were estimated to be £93.3 million, giving a benefit to cost ratio of 4 to 1. The benefits, however, included an estimate of the passenger benefits from an improved environment. These were calculated from a survey of passengers and were estimated to be £32.8 million. Subsequent work suggests that passengers would be willing to pay only about one-third of this amount for these benefits. The other passenger benefits were based on time savings to passengers, which are considered to be more reliable.

Sensitivity

11.75. The only sensitivity at this initial stage on the case for advancing the replacement of the trains on the Northern Line was to calculate the benefits excluding those from an improved environment. This reduced the benefit to cost ratio to 2.1 to 1.

Conclusions and recommendations

The basis for planning the UIP

11.76. The UIP serves both as a means of identifying all the projects that LUL considers worthwhile and as a means of planning actual expenditure on projects. If a project cannot gain a high enough priority for an early start it normally stays in the UIP but is deferred to a later date. The 1990 UIP had a planned expenditure for 1991/92 of £803 million, well over the projected funds available, and the plans had to be cut back to £384 million to stay within the funding anticipated. Considerable effort had then to go into deciding on these reductions, including an internal report to assess how they were likely to affect safety on the Underground.

11.77. We conclude that the planning process within the UIP has in the past been based on unrealistic assumptions about future levels of funding which cause problems in arriving at well considered investment plans which take full account of the interrelationship between projects and the effect of the level of expenditure on the achievement of Business Goals. LUL is now developing a new process to produce the UIP. This provides three scenarios: guideline funding provided by LRT taking account of the Treasury Guidelines for future funding; essential expenditure; and desirable levels of expenditure. In addition, the prioritisation categories now attached to all investment proposals should provide a means of adding or omitting projects if funding is made available at a different level from that expected.

11.78. We recommend that the UIP for future years should be based on the scenario approach for the Underground system proposed by LUL and should spell out the implications of different levels of funding, including the interrelationship between projects and the effect on the achievement of Business Goals.

Measuring how well the UIP objectives are achieved

11.79. In the past LUL has not measured actual project expenditure against the objectives set in the UIP. LUL is developing an enhanced IPCS which will allow it to show both the financial effects of projects and the passenger benefits associated with them. LUL intends to use this information to derive operating budgets which reflect the benefits that should be realised from the projects and plans to show budget investment against out-turn in future years.

11.80. We conclude that LUL should measure how well it has achieved its objectives from its expenditure in the UIP.

11.81. We recommend that LUL should measure its out-turn expenditure in the UIP against its priorities and objectives and should analyse the benefits achieved from completed projects in terms of these priorities and objectives.

Use of cost benefit ratios in setting priorities

11.82. In the past LUL has not ranked its projects by their cost benefit ratio. IPCS will make this considerably easier in the future. LUL has told us that it sees problems with using cost benefit ratios for setting priorities as they do not reflect the absolute cost of a project, how quickly the project provides a net return or effects which cannot be quantified. Nevertheless, it recognises that cost benefit ratios are one of the means of assisting in making decisions on priorities and will examine ways of using them more systematically in the future.

11.83. We conclude that LUL should use the information on both costs and benefits and the financial effect of projects more systematically than it has done in the past.

11.84. We recommend that LUL should, within the next UIP, make more systematic use of information on cost benefit ratios and the financial impact of projects in arriving at its project priority ranking.

Appraisal of safety projects

11.85. LUL is developing a detailed methodology for assessing safety projects which compares the likelihood of an incident against its probable severity. LUL's approach in this area is commendable.

11.86. We recommend that LUL should ensure that a full risk assessment in the appraisal of safety projects is in place by 1992.

Investment appraisal: consideration of options

11.87. In developing projects LUL develops the best option judged on cost benefit criteria within the framework of the Business Goals. Within the funding constraints priorities are then set between different projects. In the past LUL has not normally presented different options with different funding constraints, except for a limited number of projects, and has not normally looked at the funding implications of delaying projects. LUL accepts that it needs to do more and, in some areas, it is constructing models to address the effects of trade-offs between renewals, replacements and maintenance.

11.88. We conclude that LUL should do more to present options to the LRT Board, including the different funding implications, and to do more in assessing the effect of delaying projects on its costs, for example the effect on maintenance costs.

11.89. We recommend that LUL in its investment appraisal should:

(a) include the cost of delaying a project; and

(b) develop more options to take account of possible funding constraints.

The use of modern equivalent assets in investment appraisal

11.90. LUL assesses projects which both replace and enhance assets required for the continued running of its services in two stages. First, it estimates what the cost would be of replacing the assets at the end of their life with modern equivalent assets. Secondly, it evaluates the benefits of enhancing the assets in order to improve the service. In the case of the Northern Line the modern equivalent asset will be the trains to be introduced on the Central Line, which would provide an enhanced service compared with the trains currently running on the line. LUL told us that the use of modern equivalent assets was to a certain extent arbitrary but that it considered that this was the best approach.

11.91. We conclude that the base for assessing such projects should be the cheapest way of maintaining an existing quantity and quality of service, in line with DTp investment appraisal guidance. The modern equivalent asset to be used in the case of the Northern Line represents an enhancement of the Northern Line service. We further conclude that in this case care needs to be taken that less expensive options are also considered.

11.92. We recommend that the base for assessing projects should be the cheapest way of maintaining an existing quantity and quality of service. Where modern equivalent assets are used they should be shown to be the cheapest option or other cheaper options should also be evaluated.

Sensitivity analysis

11.93. As part of its project appraisals LUL carries out a sensitivity analysis. In the case of the Central Line Project this looked at the impact of an increase in costs on the benefits and, separately, the impact of lower demand and higher demand on the project. LUL has told us that it considers more could be done to assess the sensitivity of projects to variations.

11.94. We conclude that LUL could improve its sensitivity analysis. DTp guidance is provided in this area and our recommendations are consistent with this.

11.95. We recommend that LUL's sensitivity analysis of projects should include all the following sensitivities for projects over £2 million and those considered most appropriate for smaller projects:

(a) sensitivity analysis for all benefits, based on a realistic assessment of the likely error, particularly where the calculation is subject to a high level of uncertainty, as in the case of passenger benefits;

(b) sensitivity analysis of all costs based on the estimated reliability of the cost data;

(c) sensitivity on the main underlying assumptions including, where modern equivalent assets are used, sensitivity on the value of modern equivalent assets and the assumed time when they will be replaced; and

(d) sensitivity analysis of a combination of factors, especially where factors are likely to vary together, including where possible the probability of such variations.

Project appraisal manual

11.96. LUL's Finance Directorate is responsible for vetting the appraisal of all projects and provides advice and help on project appraisal where this is needed. The Client Manual produced by the Finance Directorate does not provide as detailed advice on project appraisal as that in the Development Directorate's Project Appraisal Standards Manual, nor does it provide information on the lessons learned from previous projects.

11.97. We conclude that a detailed project appraisal manual for the whole of LUL should be developed by the Finance Directorate.

11.98. We recommend that LUL's Finance Directorate should expand its Client Manual to include more detailed advice on project appraisal, building on that provided by the Development Directorate's Train Service Development section by December 1991. This should also include advice, to be regularly updated, on best practice and the lessons learned from previous project appraisals and the various reviews of these projects.

Link between prices and the UIP

11.99. It is current DTp policy that LRT should transfer some of the burden of financing the Underground from the taxpayer to the users of the system. DTp's project appraisal guidelines say that where passengers are willing to pay for passenger benefits resulting from improvement in service the calculation should be carried out as if fares were increased to match the benefit. This leaves open the question of how these passenger benefits should be financed. In practice it is very difficult with the present fares structure to increase fares in any section of the Underground to reflect an improvement in that section, but we have been told by LUL that an improvement in services in the central area, for example, could be reflected in the price of travel in Zone 1.

11.100. We conclude that this would be a potentially important link which could provide a financial incentive to undertake projects that are justified on their benefits to passengers.

11.101. We recommend that LUL should, in its discussions with DTp, pursue the establishment of a way in which passenger benefits could be reflected in pricing policy.

Link between the UIP and quality of service

11.102. The effect of different levels of investment on LUL's ability to achieve its quality of service targets is not quantified centrally but LUL told us that its LGMs have a good idea of the effect of the UIP on their ability to achieve their quality of service targets. LUL is currently working on a planning model which it hopes to use to identify how investment feeds through to the operating performance of the system.

11.103. We conclude that this is an important link which should be evaluated and we therefore commend the additional work LUL is carrying out in this area.

11.104. We recommend that LUL should have a means of directly linking the UIP with the quality of service to show the effect of different levels of funding and mixes of project on the service level in time for the 1992 UIP.

Optimal maintenance and renewal policy

11.105. In the past LUL has based its renewal policy on engineering judgment. LUL is now developing the necessary information and analytical tools to enable it to base the decision as to the maintenance and renewal of assets on whole-life costing taking account of the effect on revenue, services and passenger benefits. The LUL Board has asked for investment and renewals strategies to be reviewed, recognising that current strategies may be out of date. LUL has prepared a `framework for an investment strategy' to be followed in these reviews. This takes full account of whole-life costs. The pumps and drains strategic initiative has been developed using this new framework.

11.106. We conclude that it is particularly important that the decision on maintenance and renewal of such key assets as the permanent way, rolling stock and signalling should be based on an optimal replacement policy which takes account of the costs, of the revenue effects and of the passenger benefits.

11.107. We recommend that:

(a) by the end of 1992 LUL should have in place full information on depreciated assets, and on all other assets by the end of 1993, covering their age, maintenance expenditure and failure records along with the analytical tools necessary to calculate optimal maintenance and renewal policy taking account of costs, of revenues and of passenger benefits; and

(b) maintenance and renewal policy for assets should balance increases in expenditure on maintenance, or earlier replacement, or both, against the likely change in revenue and passenger benefits through, for example, increased reliability. This would involve the measurement of whole-life costs and benefits. Account should also be taken of the interrelationship between assets, such as the effect of the permanent way on rolling stock maintenance costs and the expected life and reliability of the rolling stock.

12 Project management

Introduction

12.1. In the previous chapter we examined LUL's investment programme and appraisal procedures. In this chapter we examine the arrangements for managing projects from approval to completion. As can be seen from Table 11.2, the annual level of project expenditure rose from around £200 million in 1985 to around £420 million in 1990/91, excluding expenditure on new lines. LUL's investment programme reflects proposed project expenditure levels of around £500 million a year by the mid-1990s, excluding expenditure on new lines.

12.2. LUL acknowledges that its record of managing projects has been unsatisfactory in the recent period of growth in project expenditure and the priority need to implement safety works. While a significant proportion of current live projects are still running late or over budget, in the last two years new procedures have been introduced and a new project control and information system (Track) is being introduced. PSG is primarily concerned with project management. It has some 900 professional staff of whom about 250 are Project Managers. As a matter of policy these are supplemented as necessary by temporary staff and consultants.

12.3. In the rest of this chapter our examination concentrates on the new arrangements now in place, or planned, rather than on past performance. We were assisted in this part of our study by consultants.

Project organisation

12.4. The structure of LUL's project organisation is shown at Figure 12.1. In the particular circumstances of a major project, such as the Central Line Project, a Control Group may be formed comprising the directors, the client and the Project Manager.

12.5. The client, or his day-to-day deputy, the client agent, holds one of the most important roles in a project. He is the business driver for the project and is responsible for establishing the objectives, securing authorisation and delivering against the agreed objectives. Increasingly the client is required to satisfy the demands of the user of the project output, for example a line Business Manager. The client's role and responsibilities, particularly in relation to financial control, are documented in the LUL Client Manual.

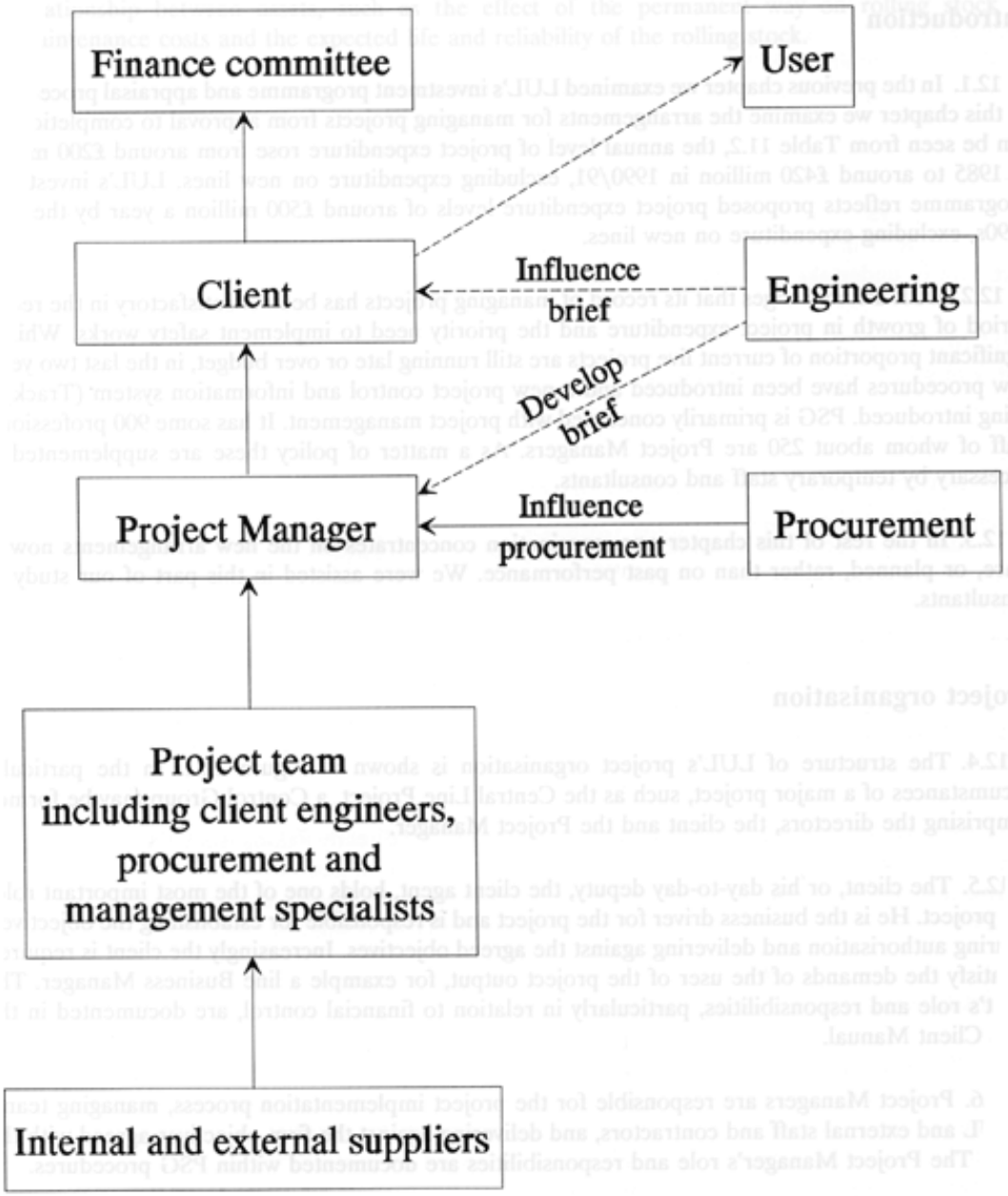
12.6. Project Managers are responsible for the project implementation process, managing teams of LUL and external staff and contractors, and delivering against the firm objectives agreed with the client. The Project Manager's role and responsibilities are documented within PSG procedures.

12.7. Project team members may be dedicated solely to a project, or they may work part-time on a project and part-time in a line management role. This arrangement with split loyalties does create some difficulties for the Project Manager, but in practical terms, LUL sees it as inevitable.

12.8. Client engineers, procurement and other functional groups have rights over the project team. LUL procedures give them power to ensure that any project satisfies their standards and operating requirements.

FIGURE 12.1

Project organisation



Source: MMC consultants.

12.9. At present there are some variations between the Project Manager's PSG procedures and the Client Manual. In particular the definition of roles and responsibilities, and the timing, content and usage of control documentation do not always agree. LUL told us that this was being rectified with a new Client Manual. The existing one was primarily concerned with financial controls.

12.10. LUL has established a training programme for Project Managers and intends to put some 200 people through it during 1991. The programme is devised and run by Reading University and covers skills such as leadership and team building in addition to the tools and techniques aspects of project management. LUL told us that it intended to introduce a formal business training programme for clients but had not yet done so.

12.11. At the time of our inquiry LUL had about 50 people working as clients or client agents. Most came from the Development or Engineering Directorates. We were told that LUL was in the process of forming client teams drawn from different disciplines and backgrounds, including PSD and line businesses. It was expected that the Development Directorate would focus on new lines and LUL-wide developments in the future.

Project benefits and risks

12.12. LUL undertakes projects to provide benefits which may be expressed in financial or other terms. Projects may be designed to create or maintain a safe system, to attract more customers or revenue, or to reduce operating costs. In the past LUL has done little to verify that the benefits claimed for a project at the authorisation stage were actually realised on completion.

12.13. Under the new procedures introduced users are required to sign the Project Expenditure Requisitions (PERs) to acknowledge that they need the benefits. The users also have to sign Project Closure Reports on completion to acknowledge delivery of the benefits. A system has now been developed for incorporating the cost and revenue effects of a project into the budgetary control system. LUL told us that the implementation of this system should start in April 1991.

12.14. Few project submissions incorporate a formal assessment of the risks inherent in implementing the project. However, LUL told us that the practicability and achievability of a project are an essential part of the design and development process prior to submission, certainly on larger projects. From time to time relatively minor repair or renovation projects have been halted when unforeseen problems, such as structural difficulties, were revealed after work had started. One example quoted by LUL was a station renovation where previously unsuspected problems with the roof were discovered. Such occurrences were rare and LUL told us that steps had been taken to improve survey and assessment work prior to project submission in order to minimise the risk of such events in the future.

Project control procedures

12.15. LUL uses a mixture of meetings and written reports to evaluate and monitor project progress. The measures of progress concentrate on current status and forecast out-turn, and contrast these with the authorised limits. Exception reporting techniques are used to consolidate information for senior management. The current level of exceptions is high, with about 50 per cent of the projects listed in the live project monitoring report classified as major exceptions, that is likely to overrun by more than six weeks or to be over budget by more than 10 per cent.

12.16. If a project strays irretrievably beyond authorised limits it must be submitted for reauthorisation. This process is normally completed in one to six weeks but may take six months. Thus it is possible for some projects to run to an out-of-authority completion. LUL's project authority guidelines generally allow virtually nothing for contingencies and all overruns have to be justified. If the overspend is greater than 10 per cent, reauthorisation has to be at a higher management level than the original authority.

12.17. LUL Standing Orders require action where the estimated cost of a project is forecast as potentially more than 10 per cent above authority, or the estimated completion date is potentially more than six months beyond the authorised life of a project. At the beginning of February 1991 the four-weekly reporting system indicated that 441 projects, including 85 with a cost of over £1 million, were in this position. The more stringent test of 10 per cent potential cost overrun or six weeks' time overrun was introduced by the Engineering Director. Monitoring reports in January 1991 revealed that, against this test, 934 out of a total of 1,634 live projects were potentially running out of authority.

12.18. Of the 85 projects costing over £1 million reported as potentially out of authority against the Standing Order tolerances in February 1991, 13 were acknowledged by LUL as giving rise to concern, of which four were over cost and nine were overrunning as to time. Of the remainder, 21 were completed but awaiting explanation of the time or cost overrun and 51 were under consideration for reauthorisation.

12.19. The 934 projects reported in January 1991 included 416 described as under query and 343 as completed apart from accounting procedures. The total also included 34 projects which had been superseded or otherwise not progressed, while 23 awaited supplementary authority and 59 were subject to revision of scope or requirements. Of the balance, 52 were subject to budget restrictions and seven delayed for legal reasons or awaiting local authority or DTp approval.

Investment Planning and Control System

12.20. LUL has devoted about £2 million to developing a proprietary computer-based system known as Track. IPCS is an essential element of this project management system. The system has been developed primarily to improve cash forecasting but is also intended to provide a schedule planning tool for Project Managers. It provides the main link between LUL's project and general MIS.

12.21. Figure 12.2 shows diagrammatically, and in simplified form, how Track:IPCS works. Track 9000 will contain a model of every current LUL project in the form of a critical path network of activities. Each project is identified by its discrete PER number and each activity is represented by:

- a unique tag and description;
- anticipated duration and time to complete;
- current progress;
- calendar and precedence constraints;
- planned expenditure;
- registered expenditure (invoices paid);
- accruals;
- anticipated expenditure to complete; and
- Project Orders (POs) associated with each activity.

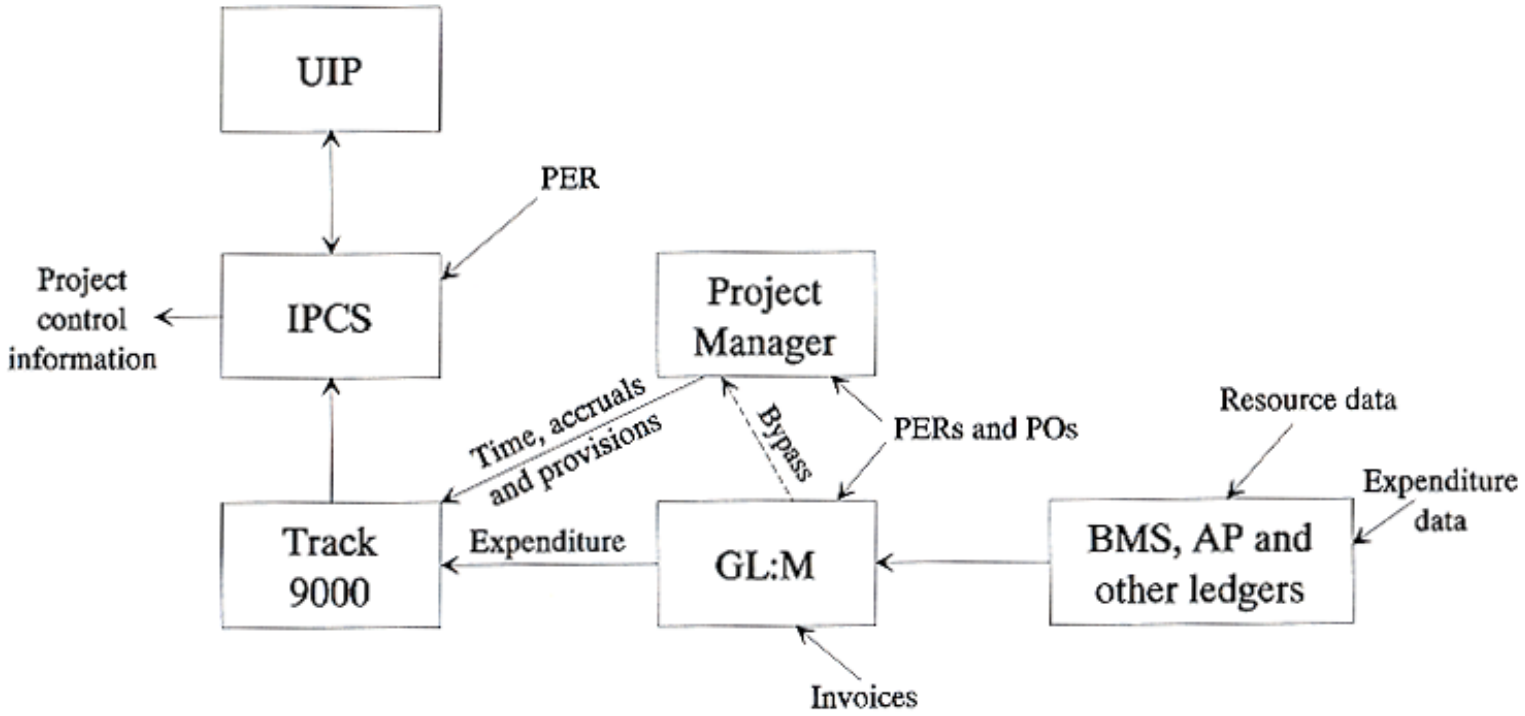
12.22. LUL's general ledger (GL:M) has been developed to accommodate project codings. All project data within GL:M, including data transferred from subsidiary ledgers, are fed into the Track model. The Project Manager is required to validate the GL:M data, add accruals and provisions to complete (including cash flow projections) and update progress and time projections on a monthly basis.

12.23. IPCS is a database tool and carries basic details of each project, reconciled with the UIP. In addition IPCS consolidates project information from the Track models, notably cash forecasts, and generates general project control information for project and financial managers.

12.24. LUL told us that about 90 per cent of project expenditure is currently monitored by the system. However, a number of projects, including the earlier started Central and Jubilee Line Projects, are not using the Track 9000 system. In these cases a bypass route is used whereby data are entered manually on a project control form rather than transferred electronically. Until very recently all project reporting has been on the basis of the value of work done, rather than on a cash basis. The project control form completed every four weeks reports the value of work done at the end of the period, an estimated final completion cost and a cumulative expenditure forecast profile by period until completion. Because of the importance of cash payments, forecasts of these are now required as well.

FIGURE 12.2

Track:IPCS management information



Source: MMC consultants.

12.25. LUL told us that development of the system was now nearly complete and most of the technical difficulties had been overcome. Future projects would use the full system and current major projects would be transferred on to the full system where appropriate.

12.26. We found during our enquiries that some Project Managers were reluctant to use the full system, largely because of difficulties experienced in its earlier development. These included slow processing speeds and high user charges. Track is a complex tool and without ready access to a terminal managers find it difficult to develop their skills. Furthermore the Track system is seen by some Project Managers as too complex for smaller and simpler projects.

12.27. LUL is currently taking action to speed up processing and is providing critical path training. A dedicated project support unit has been set up to provide a planning resource to managers. It will also undertake trouble-shooting on planning or Track system problems, work to enhance the system and service a user group.

Conclusions and recommendations

Project organisation and resources

12.28. LUL acknowledges that its past record of project management has been unsatisfactory and it has taken action over the last two years to improve matters. As part of the reorganisation of the Engineering Directorate in November 1988, PSG was created in April 1989 to act mainly as a project delivery group. It has some 900 professional staff of whom about 250 are Project Managers. As a matter of policy these are supplemented as necessary by consultants, agency staff and short-term appointments according to the nature and needs of the capital programme. LUL has also established a training programme for Project Managers which is being run by Reading University. We conclude that LUL has now taken adequate steps to assess the resources required for managing the increased level of project activity and to plan the provision of those resources.

12.29. Each project has a client or client agent who takes responsibility for maintaining the business focus, while the Project Manager is responsible for delivering against the client's requirements and within the client's constraints. The relationship between the client and the Project Manager is crucial to the success of a project but the development of the client role was commenced much more recently than project management and formal training has received less attention, therefore, than that of Project Managers. Furthermore clients do not have a specialised business client manual for project work other than a Client Manual on financial aspects of project work. LUL told us that it is now in the process of forming client teams drawn from different backgrounds and disciplines and intends to institute a formal business client training programme and to produce a client manual compatible with that used by Project Managers. We conclude that LUL is now taking appropriate steps to develop the client function but needs to speed up the provision of formal training and adequate instruction manuals beyond the financial area.

12.30. We recommend that LUL should institute a formal training programme for business clients by April 1992 and produce a comprehensive business client manual before that date.

Project benefits and risks

12.31. Projects are undertaken to provide benefits which may be expressed in financial or other terms. In the past LUL has done little to verify that the benefits claimed for a project on authorisation were realised on completion. New procedures now require users to sign PERs to acknowledge that they need the benefits and to sign Project Closure Reports to acknowledge delivery of the benefits. LUL has also developed a system for incorporating the cost or revenue effects of a project into the budgetary control system. Implementation of this system should start in April 1991. We conclude that LUL has now taken sufficient steps to ensure the realisation of project benefits.

12.32. LUL does not have a formal risk assessment process prior to project authorisation. However, the practicability and achievability of a project are an essential part of the design and development process

prior to submission, certainly on larger projects. From time to time minor repair or renovation projects have been halted because of unforeseen problems, for example structural difficulties revealed as work progressed. We conclude that LUL takes necessary reasonable steps to ensure that projects can be taken to completion.

Project control

12.33. Over the five years from 1990/91 the annual average level of capital expenditure will be about twice the annual average for the preceding five years. The increased level of expenditure includes some major projects, such as the Central Line modernisation, but also reflects a substantial increase in the number of smaller projects in progress. In October 1990 LUL reported a total of 1,634 live projects.

12.34. Where projects overrun on time or cost the process of revalidating the authority is normally completed in one to six weeks but may take six months. Thus it is possible for some projects to run to an out-of-authority completion. Project authority guidelines now allow virtually nothing for contingencies and all overruns have to be justified. Where an overspend is more than 10 per cent reauthorisation has to be at a higher management level than the original authority.

12.35. LUL Standing Orders require action where the estimated cost of a project is forecast as being potentially more than 10 per cent above authority or the estimated completion date is potentially more than six months beyond the authorised life of a project as revealed by the four-weekly reporting system. At the beginning of February 1991 441 projects, of which 85 were projects with a cost of over £1 million, were reported as being in this position. A more stringent test imposed by the Engineering Director of 10 per cent potential over cost or six weeks' overrun as to time revealed that in the four weeks to 5 January 1991, 934 of a total of 1,634 live projects were potentially running out of authority.

12.36. Of the 85 projects costing over £1 million reported as potentially out of authority against the Standing Order tolerances in February 1991, 13 were acknowledged by LUL as giving rise to concern. Four were over cost and nine overrunning as to time. Of the remainder 21 were completed but awaiting explanation of the time or cost overrun and 51 were under consideration for reauthorisation.

12.37. The 934 projects reported in January 1991 included 416 described as under query and 343 as completed apart from accounting procedures. The total also included 34 projects which had been superseded or otherwise not progressed, while 23 awaited supplementary authority and 59 were subject to revision of scope or requirements.

12.38. We conclude that under existing reporting criteria and arrangements too large a proportion of projects appears to be actually or potentially out of authority and that the existing reauthorisation procedures are too slow.

12.39. We recommend that while LUL has already taken steps to sharpen the financial control criteria to highlight more serious problems it should by October 1991:

(a) establish a mandatory quick review procedure for major overruns or overspends;

(b) categorise and monitor the cause of overruns on a regular basis; and

(c) consider the use of individually set control criteria according to the size or type of project.

12.40. LUL has devoted some £2 million to developing a proprietary computer-based system known as Track as an essential element of its project management system. As an interim measure LUL has a project control procedure which effectively bypasses the Track part of the system. Currently a number of projects, including the earlier started Central Line and Jubilee Line Projects, are not using the full Track system. While development of the system is nearly complete and most technical difficulties have been overcome, Project Managers are not making full use of it. Furthermore, the system is seen as too complex for smaller projects.

12.41. We conclude that LUL has developed an effective project management system but will not gain the full benefits until all major projects use the system.

12.42. We recommend that LUL should ensure that, by October 1991:

(a) all major projects and most other projects use the full Track system;

(b) Track has the processing capacity to handle the anticipated workload;

(c) managers have ready access to equipment; and

(d) it has developed a simplified version of Track for use on smaller projects.

13 Commercial use of assets

Introduction

13.1. Paragraph 1*(h)* of our terms of reference requires us to consider `whether LUL makes full commercial use of assets, including the use and redevelopment of properties in its operational use, and in the provision of ancillary services and concessions'. While LUL's annual revenues (excluding grants) are predominantly comprised of traffic receipts, other income, generated through the commercial exploitation of the LUL estate, is also important to LUL, as shown in Table 13.1.

TABLE 13.1 **Summary analysis of LUL's annual revenues, 1988/89 to 1990/91**

£ million

	1988/89 actual	*1989/90 actual*	*1990/91 budget*
Traffic income*	431.6	461.9	552.6
Other income	35.9	41.7	43.8
Total	467.5	503.6	596.4

Source: LUL.

*Includes car park receipts.

13.2. Broadly speaking LUL's secondary income is made up of three key components: property rentals, commercial advertising and other commercial activities. Capital receipts from the sale and/or development of property assets, being an integral element of the IFR bid process, form part of LRT's EFL and are not shown in Table 13.1. Appendix 13.1 provides further details of LUL's ancillary income and associated expenditure.

13.3. In practice LTP (see paragraph 3.6) acts as an agent in partnership with LUL for all property transactions, while LRT's Director of Trading has responsibility for the majority of non-traffic group revenues. LUL told us that it was now considering the extent to which accountability, including that for the exploitation of commercial assets, could realistically be transferred to its line businesses. In this chapter we focus first on the arrangements for the generation of income from LUL's property assets, including the use and redevelopment of properties in LUL's operational use. We then consider LUL's commercial use of assets in the provision of ancillary services and concessions, turning first to commercial advertising and then to other commercial activities.

Property development and management

The LUL estate

13.4. Through the London Regional Transport Underground Railway Asset Transfer Scheme of March 1985 LRT vested in LUL an estate comprising predominantly operational (as distinct from non-operational, or surplus) land. Thus the LUL estate differs markedly both from the BR estate reviewed by

the MMC in 1984/85[1] and from more conventional portfolios. LUL's development opportunities are comparatively limited, while the scope conventionally to trade up and continuously improve the property and tenant base is normally *ultra vires*. Moreover, LTP cannot sell freeholds on operational LUL land but must grant leases, requiring at least a peppercorn rent, so as to allow the imposition of restrictive covenants to protect LUL's operational interests (see paragraph 13.28).

13.5. LUL's estate comprises over 2,000 physical units, which may be roughly categorised as 1,100 retail units, 500 railway arches, 200 office units and 50 residential units, together with a number of licensed premises, cinemas and petrol stations. In addition there are 1,000 small licences/easements and some 350 agreements in respect of parcels of land used for storage, allotments etc. The high number of low-value assets within the LUL estate is reflected in the income profile, with roundly two-thirds of units producing 11 per cent of income.

Corporate strategy for property

13.6. Following the MMC's investigation into and report on BR's property activities we understand that the LRT Property Board and LUL closely scrutinised their own policies and organisation and adopted the report's recommendations where they applied. A letter dated 18 September 1985 from the Secretary of State for Transport to the LRT Chairman served to crystallise policies and procedures further. This letter set out general guidelines and called on LRT to submit `a comprehensive statement of the Board's strategy for property, taking into account … those points in the MMC report which are relevant to LRT'. Such a strategy was drawn up and agreed by LRT and its Property Board and approved by the Minister in a letter to the LRT Chairman dated 18 November 1986.

13.7. Though the LRT Property Board continues to review its strategies and procedure, this strategy remains the document by which property within LRT and its subsidiaries is managed. In summary the policy objectives are:

(a) to maximise property returns from development of the operational estate and sale of surplus property consistent with the requirements of LRT and its subsidiary companies;

(b) to manage actively the retained portfolio to increase revenue; and

(c) to provide commercial and professional property advice to LRT and its subsidiary companies on all property aspects.

Organisation

13.8. A chart showing the divisional structure of LTP is provided at Appendix 13.2. The LRT Deputy Chairman chairs the Property Board, while the LRT Chairman and Chief Executive is also Chairman of LUL. Thus co-operation between LRT, LTP and LUL, and between property and operations, is promoted at the highest level. LUL acknowledged that conflicts could arise between operational and property priorities but considered that LTP adopted a properly balanced approach.

13.9. At middle-management level LUL's Property Development Manager and Network Planning Manager provide the liaison between LUL and LTP on day-to-day issues. The role of the Property Development Manager, who ensures that LUL's operational needs are co-ordinated and incorporated in development briefs, is principally to act as an informed and demanding client, monitoring, advising and cajoling where necessary.

13.10. Approximately 65 per cent of LTP's workload for the LRT group is for LUL. LTP's chief remits in relation to LUL are:

---

[1]See *British Railways Board: Property Activities. A Report on the efficiency and costs of the British Railways Board in its property activities* (Cmnd 9532), published June 1985.

(a) Operational-undertakes sales of surplus LUL property and is responsible for the purchase of land for new lines and other operational purposes.

(b) Development-identifies and progresses major opportunities to develop LUL's surplus property and airspace rights above stations.

(c) Commercial-is responsible for the day-to-day management and exploitation of LUL's surplus and non-operational property assets.

13.11. Under the provisions of LRT Standing Order No 7 less than one-third of land and property transactions are of such value as to require authority from the Property Board. However, this delegation of responsibility has built-in quality control and safeguards whereby senior management decisions are regularly reported to higher authority for ratification.

13.12. LTP's current Property Asset Register, which became fully established in 1989, comprises a property information database together with associated maps. Following a thorough review of LTP's computer requirements it is proposed (subject to financial authority from LRT) to introduce a new Intergraph System, with the textual database and digitised maps integrated in a single system. This will considerably enhance the quality and speed of reporting and extent of sorting. As part of the same review a new MENTOR Property Management System is to be introduced (see paragraph 13.20).

Professional resources

13.13. The foregoing management structure and organisation is reinforced by the tight, localised nature of the estate, the physical proximity of all LTP staff within one building and a close team structure comprising a relatively small core staff. Wage levels for junior employees without professional qualifications may well be above those prevailing elsewhere; however, LTP stated that greatly reduced staff turnover rates in recent years had produced considerable benefits in work continuity and tight management. All staff are on performance-related pay. Accordingly the monitoring of staff output and quality control is given a high priority.

13.14. For very large and complex projects, those where there is insufficient expertise in-house (eg involving licensed premises) and those where LTP is negotiating exclusively with one party, management makes use of external consultants from an approved list reviewed periodically by the Property Board.

13.15. LTP issues a comprehensive and up-to-date management guide and staff guidance notes covering all aspects of strategy, organisation, budgets, procedure and practice. Timesheets facilitate charging-out to other departments and overall cost control.

Property development

13.16. We have referred earlier both to the comparatively limited development opportunities inherent in the LUL estate and to the conflicts which may arise between operational and development priorities (see paragraphs 13.4 and 13.8). In mid-summer 1990 LTP began a comprehensive and systematic line-by-line survey of all the holdings identified in the Property Asset Register. This exercise is proposed to be finalised by June 1991 and updated every two years. The Central Line review, already completed, has resulted in the identification of some £5 million to £10 million of additional development potential.

13.17. New development opportunities are also identified through approaches from adjoining owners/developers, internal reviews of existing land holdings and the monitoring of local planning policy documents. In addition LTP undertakes a rigorous and far-reaching analysis of the development opportunities afforded by new lines. LUL told us that its LGMs now played an increasingly pro-active role in identifying new commercial opportunities in general, although operational safety considerations remained of paramount importance.

13.18. Sites are usually offered only on the open market, with the benefit of planning permission or an agreed development brief. Unsolicited approaches are given priority where they give rise to `marriage value', ie where the purchaser is in a special position and can afford to pay a higher price than the market at large. LTP's profit-sharing policy is framed to ensure that it receives a substantial proportion of any extraordinary/inflationary gains whilst leaving the developer with a realistic incentive to maximise returns.

13.19. LUL recognises that car parks are a potential source of additional income, whether from disposal/development or from exploitation through linked activities such as car boot sales, car valet services etc. Essentially car parks are regarded as an important operational element of the Underground and LUL would like to provide more parking facilities. At present there are car parks at 65 stations.[2] LUL told us that, in conjunction with NSE, it was currently reviewing railway car parking strategy. LRPC said that it welcomed increased parking at outlying stations so long as land likely to be required for operational purposes was not appropriated. The London Boroughs of Harrow and Hillingdon favoured a similarly increased provision and expressed a wish for more and easily accessible free car parks, funded from DTp's roads budget; the latter particularly favoured `park and ride' car parks and the former suggested free shuttle bus services.

Property management

13.20. LTP's computerised Property Management System (PMS) holds a substantial amount of detailed information on a portfolio of over 4,000 properties (about 90 per cent owned by LUL), legal interests in land etc and performs two basic property functions:

(a) property accounting-eg PMS calculates rent due and prints bills for tenants, reports outstanding monies, identifies tenants in breach; and

(b) property records and reports-eg PMS produces on a quarterly basis diary dates for rent reviews, tenancy and lease expiry dates, options to determine and repair and maintenance dates.

An enhanced MENTOR PMS (see paragraph 13.12) will allow more flexibility with better reporting and information retrieval.

13.21. Excluding assets inextricably linked to operational land (eg kiosks, arches, substations), 75 per cent by value of LUL's property is inspected and valued each year, providing a basis to index-link the rest of the portfolio. In addition properties are always inspected at key dates (eg tenancy or lease renewals) and periodically as may be required by the Health and Safety regulations.

13.22. LTP policy, in general, is not to expend undue effort negotiating small rents at review. Most of the properties in LUL's portfolio let at small rents have been sold off or, where this is not possible for legal reasons, the rents are being commuted in capital payments to reduce administrative costs.

13.23. Normally interest at a few percentage points above bank base rate is charged on outstanding rents when reviews are settled. If rents remain outstanding the Property Business Meeting decides on the most appropriate remedy, though the general presumption is to have recourse to legal action.

13.24. LTP and LUL periodically review a number of standing investments for potential to generate additional capital receipts and release marriage value. However, decisions to dispose must take account, above all, of the safety and integrity of the railway, as well as of economic and financial considerations. Few, if any, such sales have been effected (see also paragraph 13.30).

---

[2]LUL directly controls 59 car parks, providing spaces for 10,587 cars; six car parks are leased out and therefore not directly operated by LUL.

13.25. Performance is measured by LTP using the following indicators:

(a) average annual percentage growth in rents-comparisons made with standard external indices, though considered of limited value as LTP has no scope to pick and choose its assets;

(b) reference to other sectors of the market by comparable open market transactions;

(c) liaison with, and use of, external consultants; and

(d) comparative performance of individual teams within LTP and with regard to levels of vacant premises and balance of debt against rent roll.

Case studies

13.26. Our consultants carried out nine detailed case studies selected to illustrate a cross-section of LTP's current property development and management practice. Four property development studies appraised one development of non-operational land, two developments of airspace rights and one development of a retail unit, while five property management studies assessed two rent reviews, two lease renewals and a letting of a trading concession. In addition LTP's standard lease was reviewed.

13.27. Some surveyors were found not to have noted files to record certain important meetings, telephone conversations or other developments.[3] The studies also showed that until about 1985 LTP had tried to undertake property development itself on a broad front and made little progress: since then it has focused on fewer schemes and marketed sites for others to develop, with beneficial results.

13.28. LTP uses a standard draft lease which may be modified, as appropriate, for individual properties and circumstances. Two omissions of clauses which would normally be expected to be included were noted by our consultants-and promptly remedied, by instructions from LTP to its solicitors to draw up relevant clauses for all new leases. A number of clauses in the standard lease are more onerous than normal, owing to the need to satisfy LUL's strict operational and estate management requirements. Some such clauses (eg relating to re-entry and/or determination), where applicable, may have a significant adverse effect on rental values.

Ring-fencing of property receipts

13.29. As part of the IFR bid process and subsequent EFL set by the Government a fixed cash sum is agreed between LRT and DTp for the capital proceeds from disposal and development of property. In the IFR of 1988 it was decided that this capital sum should be ring-fenced, with the result that if the sum is exceeded in any given year a corresponding reduction is made in the grant payable by DTp. Any shortfall must be compensated either by increased income or by reductions in expenditure in LRT's operating divisions. By far the largest controllable element of expenditure is LUL's investment programme, from which most of any such shortfall must therefore be found.

13.30. LTP told us that a balanced mix of premium, operational benefits in kind and rental income was sought in its Development Programme. In particular it would be in contravention of the Property Strategy were it to act uncommercially, in order not to exceed the agreed ring-fenced property receipts figure, and this it had never done. Each case was considered on its individual merits. Other things being equal, no assets would be sold unless their capital value on disposal exceeded the net present value of the relevant income flow. Further, in the current property market LTP would regard almost any major property disposal as a distress sale.

---

[3] The provision of a new retail kiosk in the booking hall at Charing Cross station is probably the most notable case in point: the case file held no note explaining a change in the amount of the winning tender from a specified rent *plus* 5 per cent of turnover to the same rent *or* 5 per cent of turnover.

13.31. London Tourist Board and Convention Bureau (LTBCB) argued that day-to-day Underground operations and the interests of passengers should not be prejudiced by the vagaries of the property market or the need to realise capital assets. Railway Development Society (RDS) and LCCI also criticised LUL's reliance on property receipts, while Transport 2000 considered that disposal of land or property could compromise future expansion of the network. RDS continued that, in order to retain maximum traffic, passenger needs should remain paramount, though it acknowledged that there might be scope for property development at some outer stations. English Heritage wrote that a number of LUL stations were listed by the Department of the Environment as buildings of special architectural or historical interest and it was concerned that LUL should preserve such buildings and conserve historic areas.

Commercial advertising

13.32. The maximisation of LUL's income from the provision of ancillary services and concessions in general is the day-to-day responsibility of LRT's Director of Trading, who sits on the LRT Executive Committee. LUL's major source of non-traffic revenues other than property receipts is commercial advertising, organised through LTA.

LTA

13.33. LTA is a commercial management unit of LRT with its own Management Board chaired by LRT's Director of Trading. Its remit is to maximise net revenue from all the advertising sites on land, vehicles and premises of the LRT group and to create and exploit new revenue-generating opportunities. LTA is not responsible for the advertising or promotion of LUL. The financial objective set for LTA (and each of LRT's other commercial activities) by the Secretary of State in April 1990 was to achieve a minimum 5 per cent return on turnover.

13.34. LTA has a total of 5,000 regular advertisers and services some 165,000 LUL advertising sites, representing about a tenth of the total United Kingdom poster market and one-third of London's poster market. Sales revenues in 1989/90 amounted to £25 million, of which LUL's proportion was about £18 million.[4] The overall surplus of the business was just under £16 million. For 1990/91 LTA's total budgeted direct sales on LUL sites amounted to some £18 million, with widely varying margins as between each of its basic advertising categories (tube car panels, platform sites, etc).

LTA's relations with LUL

13.35. LTA, with its staff of 290, is located away from LUL's Headquarters, at Camden[5] where it is able to accommodate both management and operations within the same building and at comparatively low cost. LUL's Marketing Director sits on the LTA Board, which meets at three-monthly intervals, and below middle-management level LTA and LUL staff have day-to-day working relationships. At middle-management level there is no LUL equivalent to the Property Development Manager who reports to the Marketing Director and whose role has been described in paragraph 13.9.

13.36. Some innovative LTA projects have been subject to postponement or delays (see paragraph 13.43). LUL told us that while it would be considering the appointment of an advertising equivalent to the Property Development Manager, such a post would scarcely be a full-time job and LUL would also wish to avoid any unnecessary duplication in monitoring LTA's performance. In this context, moreover, it was notable that LGMs were now taking a very active interest in the maximisation of non-traffic revenues. LUL also told us that an Executive Committee conclusion had been reached in March 1989 that it would be preferable for LTA to be taken into LUL as a division rather than privatised in the event of any future organisational change. However, it was not, either then or now, pressing for any such change.

---

[4]Further details of LUL's revenue from commercial advertising are provided in Appendix 13.1.

[5]LTA also has a depot at Walthamstow which is used to service LBL.

LTA's pricing policies

13.37. The variety of advertising sites on the Underground ranges from tube car panels to 48-sheet poster sites. LTA's prices are based on an annual rate card approved by the LTA Board. Realised prices, in common with others in the media industries, tend to be discounted by negotiation (see paragraph 13.40) or to reduce `voidages' (ie unsold sites for the time being). The Underground audience is highly rated by the advertising industry. On average LTA is able through its promotion, research and sales activities to secure premium prices compared with its competitors.

13.38. LTA's sales representatives normally sell `parcels' of space (composed either of individual sites throughout the Underground or of selected sites at particular stations) or individual sites. Emphasis is placed on maximising average net income across the network rather than from a limited number of central sites. The Product Development Manager is responsible for reshuffling the parcels to best advantage. Advertising space on `land sites' set apart from the Underground is serviced under a third-party agreement with a major poster contractor, based on the greater of a guaranteed minimum rent or 70 per cent of revenues. LUL's operational and safety requirements make cost-effective contracting out of the majority of its advertising space very difficult. LTA operates an integrated computer system to allocate space to individual advertisers, monitor voids and produce fixing rotas and inspection reports.

13.39. Both LUL and LTA agree that, for largely historical reasons, there is an excess of advertising space on the Underground. This is particularly true of sizes smaller than 16 sheets. The matter is currently the subject of an exhaustive review aimed at both rationalising and improving the presentation of the product in the market-place. LUL told us that the adverse visual impact of simply removing advertising sites from stations posed significant practical difficulties.

13.40. LTA told us that pricing adjustments must have regard, *inter alia*, to ensuring `price integrity' in the long term. Thus, for this reason, expired campaigns immediately succeeded by a voidage were not usually given free time but were replaced by filler material, such as LUL advertisements. There was currently a deepening depression in the market, with downturns in all media expenditure, and voidages were increasing. LUL stressed that advertising was a highly competitive and dynamic market. LTA's prices were negotiated commercially, subject to its overall pricing policies, with established targets and constraints, including appropriate levels of discounting authorities. The use of Tube Research Audience Classification (TRAC-see paragraph 13.43) research data was also fundamental to the objective negotiations which took place. In general, price increases could be applied to sites selling well, with reduced prices applying to those selling less well.

13.41. A comparison of average voidages with average realised prices revealed that between 1987/88 and 1989/90 LTA had almost no 48-sheet voidages, while its tube car panel voidages, in particular, rose from 16 to 40 per cent; in both cases LTA's average prices were steadily increased, year on year. However, LTA told us that by January 1991 it had reduced its 48-sheet rates by over one-third in response to a sharp decline in the market and that tube car panel voidages had fallen to around 25 to 30 per cent following a 10 per cent price reduction.

LTA's costs and revenues

13.42. As LTA staff do not keep timesheets and may fix different types of poster in a single shift, from time to time LTA carries out sample work measurement studies for the purpose of apportioning direct costs to each category of advertising site. Indirect costs (including administration, warehousing, etc) are apportioned pro rata with sales revenues in preference to pro rata with direct costs. LTA pointed out that all its sites generated revenue and told us that this was apportioned by category of site and (since April 1990) to each of the line businesses, thereby encouraging line management involvement at the local level.

LTA's research and development (R&D)

13.43. LTA has an external consultant responsible for developing new products and pioneering sales. It told us that it was continually putting forward innovative ideas: some of these, such as video/television advertising screens and back-illuminated panels, had had protracted development periods of several years or had been postponed. An important element of its R&D programme was a photographic survey of all LUL stations to assist in the complete re-evaluation of current and potential site positions, size and design for new advertisements. A project to introduce advertising on tickets was at a development stage and under serious consideration. LTA also regarded its TRAC campaign planner as one of its most important pieces of innovative R&D.

13.44. LRPC expressed the view that poster advertising on the Underground was generally welcomed by passengers; however, it was opposed to the introduction of broadcast advertising.

Other commercial activities

13.45. LUL took over responsibility for its retail programme from LTP in April 1989. In July 1990 an LUL five-year Retail Business Plan was approved by the LUL Board. This plan was designed to raise net income from retailing, arch lettings, vending, telephones, telepoints and `Photo-Me' machines from £9 million in 1989/90 to £17.5 million in 1994/95.

13.46. A key thrust of the Retail Business Plan was the commercial exploitation of station premises. LUL told us that it had surveyed a total of 220 stations and identified the potential (consistent with operational/safety requirements) for 103 additional retail units. After an allowance for construction periods and letting voids the payback period was estimated at 2½ years, with an annual return of over 50 per cent on budgeted capital costs of £3.63 million by 1992/93. However, as LUL's investment requirements exceeded the funds available the project had had to be suspended. LUL told us that it was investigating alternative funding arrangements.

13.47. LUL's existing retail units and railway arches are also in the process of being surveyed for possible refurbishment, subject to LUL's current funding constraints and operational/safety requirements. Both refurbished and new retail units will conform to new design standards-including a corporate retail design identity-currently being incorporated into a retail design manual. In addition major expansion of retailing stock is projected, through station development schemes, and a comprehensive appraisal of retail potential by external consultants is in progress.

13.48. The retail use of railway premises was welcomed by LRPC and the London Borough of Harrow, subject to operational and safety considerations. LFCDA informed us that it would oppose any new commercial developments below ticket hall level. Any commercial developments which would adversely affect the means of escape from a station would also be opposed.

13.49. LUL's 600 wall-mounted mechanical vending machines are life-expired. Partly, also, as a result of increasing vandalism all these machines have now been taken out of operation. The Retail Business Plan proposed the installation of up to 1,000 state-of-the-art electronic vending machines within two years. Following satisfactory trials, concluded in August 1990, the LUL Board authorised the £4.7 million purchase of the machines, which were found to meet all LUL's requirements as regards efficiency, reliability and resistance to vandalism. The trials suggested a payback period of just over two years. At the estimated rate of sales the investment would have shown a net present value (at the usual 8 per cent discount rate) over five years of £4.3 million. However, like the retail units the vending machine programme has had to be deferred pending investigation of possible alternative funding arrangements.

13.50. Hitherto LUL's public telephone revenues have come solely from site rentals but future contracts are to specify a percentage of turnover as well. Wider availability of public telephones was recommended in the Fennell Report and it is now LUL policy to provide telephones on all station platforms and ticket concourses as quickly as possible, following the completion of successful trials. Tenders are being sought and LUL's target is for at least one telephone per platform by the end of 1991. All installation costs are to be met by the telephone companies, other than the provision of electricity supplies where necessary.

Consultants were appointed by LUL to design a standard integrated housing for platform telephones and the proposed new vending machines with shared electricity supply; in addition the vending machines would dispense the necessary phonecards. The annual profit per unit would amount to several thousand pounds.

13.51. Agreements have recently been reached with three telepoint cordless telephone operators for the free installation of base-station equipment on LUL premises. The equipment housings will incorporate the new corporate retail identity; moreover, LUL will incur no significant operating costs.

13.52. Photo-Me Ltd operates at present 67 automatic passport photograph machines at LUL stations. These are being redesigned, both to meet LUL fire safety requirements and to incorporate LUL's new corporate retail identity, and will be supplemented by an additional 60 new machines. No installation or significant operating costs will be incurred by LUL. Under the terms of a proposed `global agreement' LUL is to receive a minimum rental plus percentage of turnover per machine and reserves the right to deal with any competitor offering superior equipment, or the facility of equipment should Photo-Me unreasonably refuse to equip any site offered to it by LUL.

13.53. `Televenture' is an LRT operation under the supervision of LUL's Marketing Director, aimed at selling wayleaves to run cables through LUL's extensive network of tunnels and former tramway/trolleybus duct systems. LUL is the sole beneficiary of the revenues, amounting to some £500,000 per annum, generated in the form of annual rentals. Principal customers are Mercury Communications Plc, London Electricity Plc and several cable television companies. Extended agreements embodying the negotiated revenue structure are inflation-indexed and/or contain review clauses to `market value'. No installation or other costs are carried by LUL. Negotiations with two potentially major new customers are currently in progress and promotional material is being prepared to expand the market where possible.

13.54. As described in paragraph 5.17, work has started on planning a high-capacity, LUL-wide data communications system, utilising the FDDI standard for fibre-optic networks. Consideration is being given to selling spare capacity to third parties on a commercial basis.

13.55. LUL is in the final stages of viability analysis in respect of a proposed joint venture to replant its two power stations (see Chapter 8). LUL would buy only one-quarter to one-third of the total output of the two stations under the new ownership of the joint venture company and would share in the profits from the sale of the surplus. The contract would be renewable and on strictly commercial terms enabling LUL to source elsewhere if appropriate.

Conclusions and recommendations

Financial regime and constraints

13.56. LUL and LTP have wholeheartedly adopted the principal recommendations of the MMC's 1985 report on the efficiency and costs of the British Railways Board in its property activities. Their procedures are commendable and senior staff have adopted a pro-active approach to property development and estate management. Since 1985 their strategy, organisation and disposal, development and investment decisions have been generally sound and sensible. However, the financial regime within which LUL operates appears to discourage an optimal disposal strategy for its assets. Moreover, capital rationing has been a factor in the postponement of LUL's potentially highly profitable Retail Business Plan proposals both for additional commercial units and for state-of-the-art vending machines and platform telephones. We conclude that two effects of the financial regime within which LUL operates have been to:

(a) discourage an optimal disposal strategy for LUL's assets; and

(b) cause or contribute to the postponement of a number of highly profitable commercial projects capable of significantly enhancing LUL's secondary income in accordance with the proposals in its Retail Business Plan.

13.57. We recommend that DTp should consider:

(a) undertaking a thorough evaluation of the extent to which the financial regime within which LUL is obliged to operate may lead to the setting of a less challenging budget figure for the capital proceeds from property disposal and development than would otherwise be the case and may unduly influence the timing of deals and the decision whether to take payment by way of capital receipts or rental income/benefits in kind; and

(b) assessing the extent to which LUL's non-traffic income might with advantage be increased through the implementation of commercial projects with attractive payback periods funded by suppliers or by means of more flexible borrowing provisions within the present EFL arrangements.

Relations between LUL and LTA

13.58. We note that LUL is considering whether to appoint, at middle-management level, an advertising equivalent to the Property Development Manager, who might act as an informed and demanding client, monitoring, advising and cajoling where necessary. We also note the LUL Executive Committee's conclusion that, in the event of any future organisational change, it would be preferable for LTA to be taken into LUL as a division rather than privatised. Some innovative LTA projects, eg video/television advertising screens and back-illuminated panels, have had protracted development periods of several years or been postponed. We are satisfied that there is room for improvement in the relations between LUL and LTA and we recommend that LUL should quickly determine how best to secure the necessary improvement, and take action accordingly.

LTA's pricing policies

13.59. LTA's prices are based on an annual rate card approved by the LTA Board, on which LUL has a representative. LUL told us that realised prices reflected the significance of a number of factors, including commercial negotiation and voidage levels. A comparison of average voidages with average realised prices showed that between 1987/88 and 1989/90 LTA's average prices for both 48 sheets and tube car panels rose steadily, year on year, though tube car panel voidages increased from 16 to 40 per cent while there were almost no 48-sheet voidages. As to LTA's costs, while direct costs are apportioned to each category of advertising site based on periodic sample work measurement studies, LTA has no method of apportioning indirect costs between any types of advertising site, or indeed between LUL, LBL and DLR, other than pro rata with sales revenues. Moreover both LUL and LTA agree that there is an excess of advertising space on the Underground. We conclude that:

(a) LTA could be lighter on its feet in responding to changing market conditions and so optimising its realised prices; and

(b) LTA's method of apportioning costs appears to be inadequate, in particular, for revealing the extent of any cross-subsidisation between LUL, LBL and DLR and for facilitating the rationalisation of the historically large number of advertising sites on the Underground through the identification of those from which the revenues obtained are insufficient to cover costs.

13.60. We therefore recommend that LUL and LTA should review their advertising pricing policies and costs in the course of the financial year 1991/92.

14 Quality of service

Total Quality programme

14.1. LUL acknowledges that its traditional corporate culture was inconsistent with a high quality of customer service. One of the major objectives of the creation of the line business structure was to tackle this problem. However, after this reorganisation, customer surveys demonstrated that it had not in itself produced the desired improvement in perceived quality of service. In September 1989 LUL decided to seek a further drastic change of corporate culture by initiating a Total Quality Leadership programme. This was aimed at achieving a business culture orientated towards a higher quality of service and improving customers' perception of the business. Three key areas were identified for action:

(a) increasing the clarity of leadership from the directors;

(b) developing support functions which truly supported the ten line businesses; and

(c) communicating LUL's mission statement to all levels of staff.

14.2. Senior and middle management workshops were run to give commitment to a customer-driven total quality approach.

14.3. The Total Quality Leadership programme led to LUL adopting a comprehensive quality action programme, `Aiming to Please', in March 1990. This was also known as LUL's Total Quality programme and had the objective of meeting agreed customers' requirements at lowest cost. It called for co-ordinated commitment throughout LUL from top management down and focused on the supplier-customer delivery process. The programme is continuing and has the following key elements:

(a) A General Manager (Total Quality) reporting to the Managing Director manages the programme.

(b) Regular customer surveys track customer perceptions within each of the 19 Area Business units within the ten line organisations.

(c) Employee surveys track morale and staff perception of quality of service and customer service.

(d) A `zone of innovation' was established in May 1990 to test innovative quality improvement experiments. This consists of the section of the Metropolitan and Circle Lines from Baker Street to Aldgate.

(e) A top team workshop focusing on key quality and management training issues was held.

(f) Customer Service Skills training for local managers was started to enable them to develop the skills of their front-line staff (who have already participated in customer care training).

(g) Corporate Induction programmes were started for new staff and included the `PLEASE' mission statement and the Business Goals.

(h) Links were established with existing and developing management systems including:

- the ISRS Safety Management System (see Appendix 2.2);

- Quality Assurance systems and procedures being developed to BS 5750/ISO 9000 standards (see Chapter 8); and

- Project Management Systems (see Chapter 12).

(i) The development of an integrated employee communication process was begun.

14.4. At this stage customer satisfaction surveys still show only a very limited impact on the public perception of LUL. However, since the programme has only recently reached the first front-line staff its full impact will not become apparent for some time.

Performance indicators and targets

14.5. Quality of service performance indicators and targets were established for LUL by agreement with LRT and DTp during 1989. The elements of performance are divided between train service measures, station facility measures, cleaning measures and passenger security. They are listed below and described in more detail later. The related targets are to be achieved as soon as possible and no later than April 1992.

(a) *Train service*: mileage operated; reliability and punctuality of train service; and peak capacity.

(b) *Stations*: availability of lifts and escalators; and ticket-purchasing facilities.

(c) *Cleaning*: train cleaning; and station cleaning.

(d) *Passenger security*.

Performance is published quarterly in the LRT *Review of Service Performance*.

14.6. DTp told us that its aim, when setting LUL's quality of service objectives, was to secure improvements within the existing infrastructure and without significant increases in operating expenditure. DTp did not assume the completion of any specific investment projects. The targets were designed to maximise the quality of service achievable through good management of the existing Underground system. DTp told us that the target level of achievement for some objectives was no higher than the historic performance previously achieved when operating conditions were less affected by congestion.

14.7. The LUL Board reviews the indicators set out above, the results of detailed customer perception surveys and the following additional performance indicators every four weeks:

(a) *Train service*: regularity of service; crowding on trains; quality of public address (PA) announcements; analysis of cancelled trains; trains in peak service; and probability of peak crowding.

(b) *Stations*: quality of signs and information; ease of hearing PA announcements; helpfulness of PA announcements; ease of using ticket machines; ease of exiting through ticket barriers; ease of buying tickets at offices; and station closures.

(c) *Cleaning*: cleanliness inside trains; and cleanliness of stations.

(d) *Safety and security*: safety from accident; fire and smoke incidents; signals failures; and communications failures.

(e) *General*: number of staff available; how quickly and sensibly staff react; ease of recognising staff; and public letters summary.

These are published four-weekly in the LUL Business Report.

14.8. In June 1990 the LUL Executive Committee decided to focus managers' attention on certain key headline issues by defining four short-term Business Goals related to the peak train service, the escalator service, the quality of the environment, and asset maintenance and renewal. These four Business Goals were defined as follows:

(a) *Business Goal 1*: `The maximum number of trains to be running in the peak, at regular intervals, by the end of September 1990. This means single-figure cancellations for the network as a whole.'

(b) *Business Goal 2*: `An escalator service to meet customer expectations by April 1991. This means no more than 35 escalators out of service for any reason. Emphasis is to be placed on minimising the downtime of individual machines.'

(c) *Business Goal 3*: `A welcoming and customer-friendly environment by April 1991. This has implications for cleanliness, staff presence and attitudes, technology and policing.'

(d) *Business Goal 4*: `Asset maintenance and renewal so that the system performs well and looks good. This will be a five-year programme covering track, signalling, escalators, stations and trains.'

14.9. The Passenger Services Director and the Engineering Director each have more detailed quality of service indicators that they monitor every four weeks. These generally show the causative factors which help to explain the overall performance. Each line business also produces a selection of performance indicators of varied format and content for its own use, and these are published four-weekly in the line business reports.

14.10. The Passenger Services Director monitors the following performance indicators (see Chapter 8):

- failures and delays per 10,000 passenger train miles;
- length of service delays, by cause;
- major incidents; and
- train maintenance schedules.

These are published four-weekly in the PSD Management Information Brochure.

14.11. The additional performance information reviewed by the Engineering Director is as follows:

- calls received by the Fire Protection Report Centre;
- CCTV failures;
- PA incidents;
- train radio failures;
- temporary speed restrictions;
- emergency speed restrictions;
- analysis of signal equipment failures;
- analysis of permanent way failures;
- analysis of rolling stock failures; and
- detailed reports from each department.

These are published four-weekly in the Engineering Directorate Performance Report.

14.12. LCCI welcomed the publication of quality of service statistics and believed that LRT should publicise its performance against these targets and give reasons when targets were not achieved. LRPC receives quarterly *Review of Service Performance* bulletins prepared by LRT. The format and content of these were revised in 1990 to incorporate the service quality targets. Although LRPC believed that the targets should be kept under review it welcomed them as a valuable aid for assessing the quality of performance and praised LRT's efforts to disseminate this information in the interests of promoting informed public debate. One London borough complained that LUL's performance statistics did not yet genuinely address customer satisfaction, making it very difficult to assess the validity of performance reports. Another felt that as LUL had exceeded many of its quality of service targets they ought to be reviewed.

Train service performance

14.13. Three of the DTp targets are relevant to train service performance: mileage operated, reliability/punctuality and peak capacity:

(a) *Mileage operated* is calculated by expressing the total mileage operated by trains passing a defined point on each line as a percentage of the full schedule. It is split between peak and off-peak. The target for April 1992 is 98 per cent for both peak and off-peak with a minimum of 96 per cent for any one line. The Central Line is set a lower target of 95 per cent in view of capital works being carried out. The 1990/91 budget agreed with LRT provides for 96 per cent of scheduled miles to be operated.

(b) *Reliability/punctuality*: on high-frequency lines (ie in central areas) the target is that no more than 7 per cent of passengers should have to wait more than 1½ times the scheduled interval. On branches with standard intervals of 15 minutes or more there is a punctuality target of 90 per cent of trains running on time or up to 5 minutes late. Performance is assessed by means of sample surveys.

(c) *Peak capacity*: to reduce overcrowding DTp set a target of a 5 per cent increase in the peak service by April 1992 (compared with the equivalent quarter of 1988/89). Performance is assessed by reference to operating records compiled at control centres.

14.14. Mileage operated, reliability, punctuality, and peak crowding are all strongly interrelated. Most central area lines are operating close to the technical capacity constraints determined by signalling systems, track layouts and station stop times. This means that attempts to increase the peak service by adding extra trains may have an adverse effect on regularity. Usually an increase in frequency will make it more difficult for a line to recover from any operating problem. This will in turn affect the reliability and punctuality of the service. Also, when services become less reliable crowding problems increase, as trains following gaps in the service become more heavily loaded. This further slows down such trains, making the service gap even worse.

14.15. To reduce this problem LUL's signalmen seek to regulate the headway between trains (ie to even out the gaps in the service). It is not, however, a complete answer, as regulation can involve delaying crowded trains, which is clearly undesirable. In addition signalmen are not normally aware of which trains are heavily overcrowded.

Mileage operated

14.16. The DTp mileage operated target is as follows:

> The percentage of scheduled mileage run will attain 98 per cent in both the peak and off-peak, with no less than 96 per cent of scheduled miles operated on any one line, except on the Central Line where capital works will necessitate a lower target of 95 per cent.

14.17. Business Goal 1 is also relevant (see paragraph 8.164):

> The maximum number of trains to be running in the peak, at regular intervals, by the end of September 1990. This means single-figure cancellations for the network as a whole.

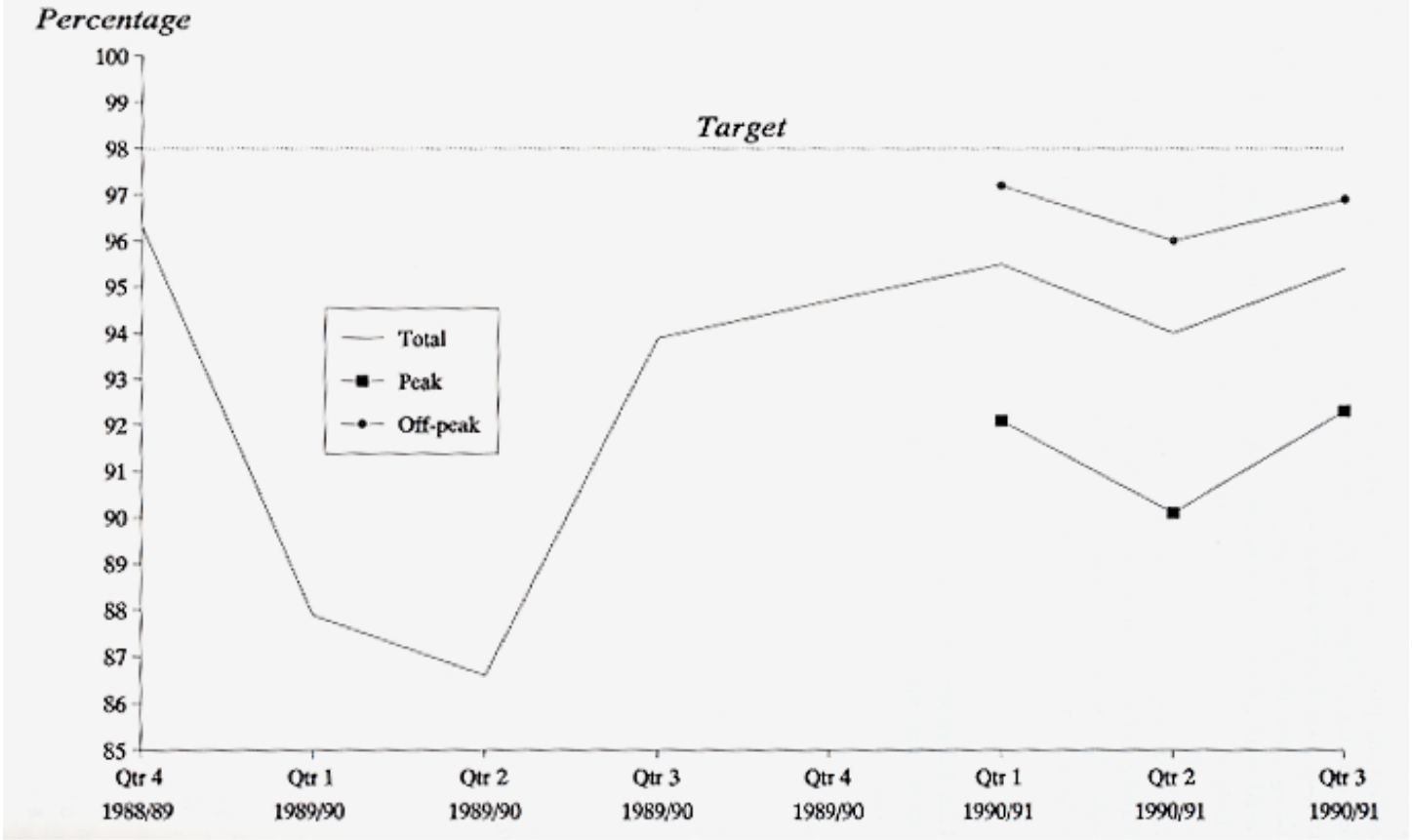
14.18. The percentage of scheduled mileage operated is derived by comparing the mileage actually operated by trains passing a specified point on each line with the full schedule, based on operating records. The overall figure is split between peak and off-peak services. Peak trains are taken to be those which arrive at a specified station on each line in the central area between 7 am and 10 am and 4 pm and 7 pm on Mondays to Fridays. The mileage operated by these trains is compared with that which should have been run by all trains scheduled to pass through during the peak times given above. All other trains are designated as off-peak. The Revenue Accountant provides the necessary information on mileage operated by scrutinising the train running registers (signal box sheets) and the Line Controllers' log reports.

14.19. In 1984/85 and 1985/86, 98 per cent of the scheduled mileage was operated. Figure 14.1 shows that the proportion of scheduled mileage operated fell subsequently, reaching 88 per cent in the first quarter of 1989/90. The lower proportion of mileage operated against schedule in 1989/90 was mainly caused by industrial action (see Appendix 6.4). On the basis that 13 days were lost, on the remaining days about 94 to 96 per cent of mileage was operated. But actual annual mileage had increased from 29.4 million miles in 1984/85 to 29.7 million miles in 1989/90, despite the loss caused by industrial action. More recent quarters show a recovery to between 94 and 96 per cent of scheduled mileage. After allowing for the industrial action the quarterly performance in the last two years to quarter 3 of 1990/91 shows no trend. Peak services in particular are well short of the 98 per cent target (92.3 per cent in quarter 3 of 1990/91). The apparent improvement in the last quarter is largely accounted for by reductions made to the schedules for the Victoria and Jubilee Lines to allow for operating problems, rather than by any improvement in the service.

14.20. There are very striking differences between lines in the mileage operated performance. Table 14.1 shows the mileage operated performance by line for the first three quarters of the current financial year.

FIGURE 14.1

Proportion of scheduled mileage operated
(target 98 per cent peak and off-peak)



Source: LUL.

TABLE 14.1 **Proportion of scheduled mileage operated, by line, first three quarters of 1990/91**

per cent

Line	*Average 1989/90*	*Quarter 1 1990/91*	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target for April 1992*
Peak					
Bakerloo		96.0	92.4	94.9	96
Central		92.0	89.7	90.4	95
District		95.0	87.5	95.6	96
East London		97.7	97.3	97.3	96
Circle and Hammersmith		92.7	88.6	91.0	96
Jubilee		90.2	90.2	92.8	96
Metropolitan		94.7	95.6	95.5	96
Northern		88.1	92.0	94.5	96
Piccadilly		93.4	95.4	92.1	96
Victoria		86.9	73.3	79.9	96
All lines	N/A	92.1	90.1	92.3	98
Off-peak					
Bakerloo		97.6	94.2	96.5	96
Central		97.0	95.0	96.7	95
District		99.2	96.5	99.0	96
East London		98.8	98.1	98.3	96
Circle and Hammersmith		96.2	94.2	95.4	96
Jubilee		98.4	98.1	98.5	96
Metropolitan		99.1	99.3	99.3	96
Northern		95.6	97.7	98.8	96
Piccadilly		98.0	98.4	97.8	96
Victoria		93.1	85.6	86.3	96
All lines	N/A	97.2	96.0	96.9	98
Total					
Bakerloo	85.4	97.1	93.6	96.0	96
Central	91.7	95.2	93.1	94.5	95
District	93.8	97.8	93.4	97.8	96
East London	95.2	98.5	97.8	98.0	96
Circle and Hammersmith	90.0	95.2	92.6	94.2	96
Jubilee	91.0	95.8	95.5	96.6	96
Metropolitan	92.8	97.6	98.0	97.9	96
Northern	89.2	93.1	95.7	97.3	96
Piccadilly	92.5	96.6	97.5	96.0	96
Victoria	87.1	91.2	81.6	84.3	96
All lines	91.5	95.5	94.0	95.4	98

Source: LUL.

14.21. LUL places most of the blame for areas of poor performance on various technical and maintenance problems with its rolling stock, including the following problems on particular lines (see paragraph 8.20):

- Victoria Line: rolling stock shortage caused by wheel wear problems.
- District Line: rolling stock shortage caused by urgent safety modifications.
- Circle and Hammersmith Line: rolling stock shortage caused by premature gear drive failure.
- Piccadilly Line: rolling stock shortage caused by urgent safety modifications.
- Jubilee Line: motor alternator problems.

The Northern Line management team has, however, achieved a remarkable improvement in performance, by management action to identify the causes of train cancellations and to tackle them directly. Staff absence has, in particular, been drastically reduced (see paragraph 8.165). Off-peak services are close to achieving the overall DTp target of 98 per cent and most lines are achieving their targets. Peak services are, however, well short of their target, at 92.3 per cent. The poor performance of the Victoria Line significantly affects the overall results.

14.22. LUL is seeking to improve its performance by achieving the full staffing of the train service, reducing absenteeism and improving rolling stock maintenance and reliability. It is using Business Goal 1 as its immediate objective, ie reducing total daily train cancellations to single figures. Table 14.2 shows the average daily train cancellations in the morning and evening peak periods. The underlying causes are considered in Chapter 8. Although a significant reduction in cancellations due to staff absence has been achieved, progress on cancellations related to rolling stock is limited.

TABLE 14.2 **Average daily peak period train cancellations**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target (Business Goal 1)*
Morning peak	27	32	22	-
Evening peak	24	37	22	-
Total	51	69	44	10
Breakdown by cause				
No driver/guard	12	8	3	-
No rolling stock	20	32	22	-
Defective rolling stock	11	17	11	-
Other	8	12	8	-

Source: LUL.

Reliability and punctuality

14.23. The DTp reliability and punctuality target is as follows:

> No more than 7 per cent of passengers will wait more than one-and-a-half times the scheduled interval. On low-frequency branches (ie those with standard intervals of 15 minutes or more) 90 per cent of trains will run on time or up to a maximum of 5 minutes late.

14.24. The first part of the target highlights the proportion of passengers having to wait, on average, significantly longer than they should have if the service had operated as scheduled. This is measured by four-weekly surveys at 54 stations spread throughout the Underground, with observations made at several times of day in each case. Train checkers are employed and make sample observations in respect of 2 to 3 per cent of the total service. There are no observations at the extremes of the day. For the target relating to low-frequency services, trains categorised as `on time' are those running between 2 minutes early and up to 5 minutes late. The same survey is used to assess their performance. This includes observations at busier stations where only a low-frequency service is operated to some destinations.

14.25. These measures are used to give broad indications of level of performance and trends. As technology allows, LUL intends to move to 100 per cent sampling using computer-control monitoring information (this is about to be used for DLR). Sample sizes have recently been adjusted to provide acceptably reliable figures at a line level. The 95 per cent confidence limits at line level are now about ±0.2 minutes. At system level this equates to 95 per cent confidence limits of significantly less than 0.1 minutes.

14.26. Quarterly performance compared with the 1988/89 base year and the target for April 1992 is shown in Table 14.3.

TABLE 14.3 **Reliability and punctuality**

per cent

	Average 1988/89	*Quarter 1 1990/91*	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target for April 1992*
High-frequency services					
Passengers waiting more than 1.5 times scheduled interval	8.6	8.6	10.1	9.5	7.0
Low-frequency services					
Trains up to a maximum of 5 minutes late	85.1	87.1	83.3	85.3	90.0

Source: LUL.

14.27. There is no obvious consistent trend in either the reliability or the punctuality performance but the reliability of the high-frequency services has deteriorated since 1988/89 despite an improvement in the last quarter. A considerable improvement in performance will be required if either target is to be met.

14.28. Table 14.4 shows the average wait actually experienced by passengers compared with the time they would wait if the service ran as scheduled, together with the variation in the time that passengers can expect to wait.

TABLE 14.4 **Waiting time: high-frequency services**

	% chance more than 1.5 times scheduled interval	*Average wait (minutes)*			*Chance of waiting (%)*			
		Scheduled	*Excess*	*Actual*	*Less than 5 minutes*	*5 to 10 minutes*	*10 to 15 minutes*	*More than 15 minutes*
Average 1989/90	9.9	2.5	0.9	3.4	78	16	4	2
Quarter 1 1990/91	8.6	2.5	0.8	3.3	80	15	3	2
Quarter 2 1990/91	10.1	2.5	1.0	3.5	78	16	4	2
Quarter 3 1990/91	9.5	2.5	0.9	3.4	79	15	4	2
Target	7	-	-	-	-	-	-	-

Source: LUL.

14.29. Table 14.5 summarises the recent punctuality record on low-frequency services.

TABLE 14.5 **Punctuality: low-frequency services**

	% chance of a train			
	Departing on time or within 5 minutes after	*Departing early*	*Departing 5 to 15 minutes late*	*Not arriving or more than 15 minutes late*
Average 1989/90	85.4	1.2	5.5	7.9
Quarter 1 1990/91	87.1	1.8	4.9	6.2
Quarter 2 1990/91	83.3	1.6	7.0	8.1
Quarter 3 1990/91	85.3	1.7	5.8	7.2
Target	90	-	-	-

Source: LUL.

14.30. Table 14.6 shows an analysis of the reliability of the high-frequency sections of the lines in the third quarter of 1990/91. The variation between lines is striking, with the most crowded lines showing the worst performance.

TABLE 14.6 **Reliability of Underground services by line, quarter 3 1990/91**

	% chance of waiting more than 1.5 times the scheduled interval between trains	*Average wait (minutes)*		
		Scheduled	*Excess*	*Actual*
Bakerloo	7.0	1.8	0.6	2.4
Central	12.1	2.7	1.2	3.9
District	9.3	2.7	0.9	3.6
East London	1.1	5.7	0.3	6.0
Circle and Hammersmith	7.9	4.2	1.4	5.6
Jubilee	7.5	2.3	0.5	2.8
Metropolitan	6.4	4.9	0.8	5.7
Northern	9.1	2.7	0.8	3.5
Piccadilly	8.8	2.2	0.7	2.9
Victoria	12.8	1.8	0.9	2.7
All lines	9.5	2.5	0.9	3.4

Source: LUL.

14.31. Customer attitude surveys have been carried out every four weeks for LUL by a market research company since period 3 of 1990/91. Approximately 1,100 customers are interviewed about 22 measures of satisfaction as they leave stations. Table 14.7 shows the results. These indicate a significant upward trend in the overall satisfaction ratings[1] for `regularity of service' from a low initial satisfaction rating.

TABLE 14.7 **Customer satisfaction rating for regularity of service**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Satisfaction rating (out of 100)	34	37	40

Source: LUL.

14.32. The above paragraphs demonstrate that LUL uses a wide range of measures of service performance to describe its train service reliability. In assessing these it is important to identify the key factors which most affect passengers. Since high-frequency services (see Table 14.4) do not have public timetables it is important to avoid lengthy gaps, but less necessary to ensure that all train intervals are equal. Passengers rarely object to an irregular service if the interval is never greater than 5 minutes. They would, however, object to a service which 90 per cent of the time ran reliably every 3 minutes but 10 per cent of the time gave a 15-minute gap. Measures such as average and excess waiting time can disguise such major service disruptions.

14.33. The 1.5 times scheduled headway target was intended to be a compromise measure of aggregate performance. To some extent it highlights the longer than average gaps in services which irritate

[1] Three customer research ratings are produced:

(a) Current rating

Customers are asked to assess the acceptability of each factor, eg frequency of service, on a scale from 0 (worst possible situation) to 10 (best possible situation). The average of these scores is the current rating.

(b) Acceptability rating

Customers are asked to assess whether current performance on each factor is `as good as you can reasonably expect'. This is again assessed on a scale from 0 (not good enough) to 10 (as good as you can reasonably expect). Five points correspond to `acceptable, but could be improved'. This measure is designed to allow for the effect of external constraints on LUL's performance.

(c) Customer satisfaction index (overall performance rating)

This arbitrarily combines *(a)* and *(b)* by multiplying them to produce a score out of 100 and is the main measure of customer satisfaction used by LUL.

The quarterly figures shown are the averages of the data for the relevant four-weekly periods.

passengers. It fails, however, to distinguish adequately between very long gaps caused by serious disruptions to the service and marginally unacceptable gaps.

14.34. Unexpected serious disruptions to the service cause particular problems and are a notable source of passenger dissatisfaction. At the moment the most serious type of disruption is fire alarms, which amount to about 110 incidents per week all of which are attended by LFCDA (the fire brigade). In period 11 of 1990/91 no fire was found following 83 per cent of fire alarms. The fire brigade was only required to deal with a fire on 6 per cent of calls. Suicide attempts are another source of major disruptions. Although much less frequent than fire alarms, the psychological and other consequences for staff are severe and the lengths of the resulting delays can be much longer.

14.35. As in the case of mileage operated, LUL attributes most of its current reliability problems to the difficulties being experienced with the rolling stock. LUL envisages that the measures taken to improve mileage operated will also improve reliability. It intends in the longer term to improve its performance by investment in improved rolling stock maintenance, signalling, track and control systems, to enable management to regulate the service better.

Peak capacity

14.36. The DTp target for increased peak capacity set in 1989 is as follows:

> The peak service will be increased by 5 per cent by April 1992.

14.37. The estimated peak capacity is based on the number of trains passing through a specified station on each line in the central area on Mondays to Fridays from 7 am to 10 am and from 4 pm to 7 pm. This is compared with a base figure computed for the equivalent quarter in 1988/89. Comprehensive operating records compiled at control centres are used by the Revenue Accountant to calculate performance against this target.

14.38. The increase in the number of peak-period trains operated compared with the 1988/89 base year is calculated quarterly and published in the LRT *Review of Service Performance*. Recent performance is shown in Table 14.8. This target was established as a proxy for a target related to reduced crowding.

TABLE 14.8 **Percentage change in peak trains operated (all compared with same quarter in 1988/89)**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*per cent Target*
Bakerloo	+16	+20	+18	-
Central	-3	0	-2	-
Circle and Hammersmith	+5	+10	+10	-
District	-4	-4	+2	-
East London	+11	+25	+19	-
Jubilee	+12	+25	+24	-
Metropolitan	-1	+1	+6	-
Northern	+5	+11	+15	-
Piccadilly	+3	+11	+8	-
Victoria	-8	-11	-11	-
All lines	+2	+6	+7	+5

Source: LUL.

14.39. Although the target is currently being met overall, the shortage of rolling stock caused by essential modifications will result in a reduction in the level of peak services. As a result the performance against this target will be reduced in the short term. The overall increase in service to date is less significant than the wide variation between lines. Peak capacity has actually declined on the Central (-2 per cent) and Victoria (-11 per cent) Lines. This reduction has been more than offset by large improvements of 18 per cent or more on the East London, Jubilee and Bakerloo Lines. The lines that are most affected by overcrowding are showing the worst performance. The ability of the lines to deliver an increased level of service compared with 1988 is critically dependent on how close the level of service provided in that base year was to the technical capacity constraints on the line. Clearly the most crowded lines were already

operating close to their maximum capability without changes in operating methods or significant investment.

Peak-period crowding

14.40. There is no DTp target for peak-period crowding even though reducing crowding was the prime objective of CLRS. Information on crowding is, however, reported four-weekly in the LUL Business Report. This is based on the number of passengers carried on trains where the LUL planning standard loading for the rolling stock concerned, expressed as a percentage of the total number of passengers carried during the weekday peak periods of 7 am to 10 am and 4 pm to 7 pm, is exceeded. The planning standard approximates to one standing passenger for each seated passenger (see paragraph 9.8).

14.41. Train checkers are employed on a regular basis throughout the central area to provide information by estimating train loadings on sampled trains. Their reports are then compared with the planning standards for the rolling stock concerned. 2 to 3 per cent of the total service is sampled. LUL does not consider it necessary to carry out observations of crowding in the outer zones or outside the peak periods.

14.42. The probability of peak-time crowding is reported four-weekly in the LUL Business Report. Recent performance is shown in Table 14.9.

TABLE 14.9 **Probability of travelling in an overcrowded train at peak times, by line**

per cent

	Average 1989/90	*Quarter 1 1990/91*	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Bakerloo	24	17	14	18
Central	36	35	30	32
Circle and Hammersmith	6	5	5	4
District	26	25	22	24
East London	2	1	0	3
Jubilee	17	16	22	12
Metropolitan	7	6	5	16
Northern	32	33	27	26
Piccadilly	32	39	26	33
Victoria	40	34	46	46
All lines	28	27	24	27

Source: LUL.

Note: Quarterly data is based on an average of the four-weekly survey results for that quarter.

14.43. Table 14.10 shows the results of the customer surveys carried out for LUL. These indicate no trend in the overall satisfaction ratings (see footnote to paragraph 14.31) for `crowding in trains'.

TABLE 14.10 **Customer satisfaction rating for crowding in trains**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Satisfaction rating (out of 100)	19	18	20

Source: LUL.

14.44. LUL's sample surveys show some reduction from the level of overcrowding experienced in the last two quarters of 1989/90, when the probability of peak-period overcrowding exceeded 30 per cent. This is, however, largely due to a cyclical reduction in demand which should be reversed when an economic upturn takes place. Even in recent months the Northern, Victoria, Piccadilly and Central Lines have all shown four-week periods with over 40 per cent of peak trains being overcrowded. In period 8 of 1990/91 67 per cent of Victoria Line peak-time trains were overcrowded. In addition to `normal' crowding any significant service disruption rapidly causes high levels of overcrowding.

14.45. In its submissions LRPC commented that during the peaks travelling conditions were acutely unpleasant, and it was a common experience for passengers to be unable to board at some central area stations until a number of trains had passed. LRPC expressed concern at the effect on passengers of the rapid build-up of heat which occurred when densely-packed trains were held stationary in tunnels for any length of time. Overcrowding also resulted in increased journey times caused by the longer station boarding and alighting times and in greater irregularity of services. Such irregularity in turn led to a reduction in total capacity. Acute pressure on the system was focused on relatively short sections of line, on a relatively limited number of stations and on relatively short periods of the day.

14.46. LRPC added that although severe peak overcrowding was a daily experience on the most critically stressed sections of line (eg the Central Line east of Chancery Lane, the Victoria Line between Euston and Victoria and the Piccadilly Line between Earl's Court and Knightsbridge), it could also arise very quickly on almost any other section of route if there was more than a brief interruption to the planned pattern of service. Disruptions to services caused by a wide variety of events, including signal faults, train faults, staff absences, fire brigade attendances, suicide attempts and vandalism, could rapidly cause abnormal levels of crowding.

14.47. In the short term it is unlikely that LUL can significantly reduce the overall level of crowding on the system. It can, however, take action to even out the loading of trains and prevent the excessive crowding of stations by managing the overcrowding problem. This is mainly done by regulating the train service, monitoring platform overcrowding and restricting access to stations from the street, or from trains, when the platforms are overcrowded. Limiting stop times in stations can play a role but is difficult to achieve. Consideration has been given to physical modification to platforms but schemes have not met the cost benefit targets. Some line management teams favour using staff on platforms to control the crowds. Table 14.11 lists those sections of lines where a congestion problem exists (see Figure 9.4).

TABLE 14.11 **Sections of line where passenger loadings exceed planning standard capacity**

Morning peak hour 1987

Lines/sections over which planning standard capacity was exceeded during the peak hour	*Scheduled service frequency (trains/hour)*	*Planning standard capacity (passengers/hour)*	*Maximum load in section (passengers/hour)*
Bakerloo Line			
Southbound			
Baker Street-Oxford Circus	20	10,800	11,500 (Baker Street-Regent's Park)
Circle and Hammersmith Line			
Eastbound			
Edgware Road-Baker Street	15	8,250	8,500 (Edgware Road-Baker Street)
Central Line			
Westbound			
Leyton-Chancery Lane	30	18,600	26,500 (Bethnal Green-Liverpool Street)
District Line			
Eastbound			
Fulham Broadway-Earl's Court	18	10,530	11,400 (West Brompton-Earl's Court)
Sloane Square-St James's Park	30	18,030	19,000 (Victoria-St James's Park)
Jubilee Line			
Southbound			
Swiss Cottage-Baker Street	20	11,400	12,100 (St John's Wood-Baker Street)
Northern Line			
Southbound			
Archway-Camden Town	20	11,060	13,400 (Kentish Town-Camden Town)
Camden Town-Warren Street	20	11,060	14,500 (Mornington Crescent-Euston)
Northbound			
Clapham Common-Stockwell	30	16,600	18,900 (Clapham North-Stockwell)
London Bridge-Bank	20	11,060	12,100 (London Bridge-Bank)
Piccadilly Line			
Westbound			
Finsbury Park-Manor House	24	13,400	14,100 (Finsbury Park-Manor House)
Arsenal-Holborn	24	13,400	14,800 (King's Cross-Russell Square)
Eastbound			
Earl's Court-Knightsbridge	30	16,800	19,000 (Gloucester Road-South Kensington)
Victoria Line			
Southbound			
Euston-Oxford Circus	28	18,800	22,500 (Euston-Warren Street)
Northbound			
Victoria-Green Park	28	18,800	21,300 (Victoria-Green Park)

Source: LUL.

Note: No passenger loadings exceeded planning standard capacity on other lines.

14.48. Congestion problems occur at a number of stations in the central area. Limited lift or escalator capacity and restricted circulating space or waiting space contribute to unpleasant conditions for passengers when traffic flows are heavy, and restrict passenger movement. They also extend journey times. Where platform entry points and exits are restricted, station stop times can be greatly extended by crowds of passengers blocking boarding and alighting flows to and from the trains. Congestion at certain stations seriously affects the overall service provided to passengers. Solutions to most of the problems that have been identified at stations are likely to be extremely expensive given the scale of the engineering work necessary to increase capacity underground-either by enlarging ticket halls or by providing improved access to platforms. In some cases LUL has identified potential safety problems and has implemented crowd-control methods where necessary.

14.49. NSE told us that congestion at major interchanges between NSE and LUL was carefully examined. As a result there was a Bill before Parliament for interchange improvements at King's Cross.

14.50. The satisfactory long-term relief of overcrowding is heavily dependent on additional capacity becoming available in the form of new lines, enhanced signalling and station improvements (see paragraph 9.31). Apart from the large-scale projects such as Crossrail, the Jubilee Line extension, the Chelsea-Hackney Line and the Central Line Project, a substantial package of such improvements was identified in CLRS (see Chapter 3). Much of this MUP is, however, delayed by current financial constraints.

Overall quality of train service

14.51. A comparison of the combined performance of the various lines judged against the three main train service performance measures reveals that the East London Line performs consistently well and the Victoria and Central Lines consistently badly. The difference between the best and the worst performance is substantial whether in terms of mileage operated, reliability or crowding. In large part this reflects the fact that the Central and Victoria Lines are operating close to the technical constraints imposed by the signalling systems and by passenger boarding times, whilst the comparatively lightly-loaded East London Line has some spare capacity. Part of the difference in performance is, however, caused by limited rolling stock availability, attributed to design and maintenance problems.

14.52. In 1986 LUL set up a working party to examine methods of improving the quality of the train service. The Improved Services Working Party (ISWP) identified four general issues to be considered in planning increases in services:

(a) train availability as affected by:

- number of trains in stock;
- maintenance practices; and
- train performance;

(b) depot and stabling capacity;

(c) signalling capacity and methods of regulating the service; and

(d) station stop times at critical stations.

14.53. ISWP analysed what action was required to increase the service on each line. Additional rolling stock availability was a common factor and significant increases have now been made. The factors applying to each line were as follows.

- *Central Line*: The extended station stop times at Liverpool Street and Bank were a major obstacle to the operation of any service more frequent than 30 TPH in the peak. This was already well short of that required to meet LUL's planning standard for crowding.

- *Victoria Line*: Despite the peak overcrowding, both northbound and southbound, the scope for service increases was likely to be limited to those that could be generated through improved maintenance practices, service regulation and performance.

- *Northern Line*: The allocation of more stock to the line would also have required the provision of additional stabling capacity.

- *Bakerloo Line*: Additional stabling would also have been required to allow an improved service to be provided (both peak and off-peak).

- *Piccadilly Line*: Measures to increase train availability within the existing stockholding were considered to be a high priority, including improved train performance and a reduction in the spares level. No other major constraints limited the achievement of a modest increase in service up to the scheduled capacity of the line.

- *Jubilee Line*: The greater availability of trains through additional rolling stock or the allocation of a single stock-type would have enabled a more frequent peak service to be run.

- *District Line*: The provision of a significantly increased central area peak service would have required particular consideration to be given to the capacity of the critical junctions at Earl's Court, Gloucester Road and Aldgate.

- *Metropolitan Line*: In a similar way, the operation of a significantly more frequent Metropolitan, Hammersmith and City or Circle Line peak service would have required a means of providing more reversing/junction capacity at Baker Street to ease the critical bottle-neck for these services.

14.54. Improvements to the Central Line service will result when the Central Line Project is completed and additional trains will also be released for other lines. Some other services would be significantly improved if projects in the MUP are implemented.

14.55. LUL seeks to predict the effect of changes in the pattern of service by carrying out computer simulations using its TSM (see Appendix 9.1). As the load on the system has increased LUL has become more aware of the trade-off between conflicting objectives such as increased frequency and improved reliability. LUL is now seeking to explore these using the TSM.

14.56. Two London boroughs told us that improvements were needed to track and rolling stock and the signalling system. Train frequencies needed to be increased and more information given about the causes of delays. One of these boroughs felt that staff should be present to monitor overcrowding and provide the public with a sense of security.

14.57. In its submissions LRPC commented that it was keen to support any practicable measures for enhancing the capacity of the existing system. It considered that physical alterations to subterranean platforms, to permit the operation of longer trains, would be too expensive and too disruptive to be serious options. The life-expectancy and cost of rolling stock were such that replacement of the existing trains by higher-capacity vehicles with fewer seats and more doors could only be undertaken over a period of several years, even if this was acceptable to passengers. LRPC therefore considered that the only practicable way to increase the capacity of the existing system was likely to be the enhancement of train frequencies.

14.58. Significantly higher speeds were largely ruled out by the close spacing of central area stations, and the effect on standing passengers of rapid braking and acceleration. LRPC considered that station closures would provoke intense opposition, and that skip-stopping would offer no real advantage on two-track lines. The only feasible options appeared to be closer spacing of trains, and shorter dwell times at stations.

14.59. LRPC said that it would welcome any initiatives to modify the signalling system to enhance line capacity, and to encourage the more even loading of carriages to speed up the process of boarding and alighting. LRPC did, however, acknowledge that a previous attempt to enhance the Central Line peak frequency to its theoretical capacity limits proved unsuccessful, because of the repercussive effects of minor interruptions to the service. It believed that on some lines there may be scope for additional central area shuttles (eg Victoria-King's Cross and Liverpool Street-White City) to handle some of the overload arising from BR interchange passengers at peak hours.

Timetabling

14.60. All these train service issues have to be resolved in the timetabling process. Timetables are generally prepared annually. Those affected by the BR timetable are generally changed in May and are often subject to a revision after six months to accommodate BR's autumn timetables. Numerous special timetables also have to be produced during the year to take account of engineering work or major events.

Timetable requirements are specified by the LGMs who are the eventual users. They consider what changes are needed to satisfy the customer requirements forecast by Strategic Planning. Typically an LGM would consult the Train Services Development Manager, the Network Planning Manager, BR staff, his own managers, Line Control staff and managers of interworking lines, and he would take account of the views of user groups and customers before producing his required specification. Any operating problems experienced by the line and by any other connected interworking lines would also be taken into account.

14.61. The Scheduling Manager then seeks to reconcile the requirements of the LGMs with the technical constraints of the system, and with interrunning arrangements with other lines and with NSE. This is a highly complex process which makes use of the CART computer model. Appendix 14.1 describes a case study in respect of the Bakerloo Line showing how timetabling issues are resolved; details of the May 1990 change to the Metropolitan Line timetable are also included in Appendix 2.1.

14.62. The CART system does not construct a complete timetable but provides the information to enable the compiler to undertake the task (eg starting and finishing points of trains, rolling stock allocation). The more intricate areas of the timetable are generally constructed by manual input into the system. Platform allocations, however, are selected automatically by the system. Once the timetable is complete, the system generates the data to produce signal box record sheets, programme rolls, and computer data for use with signalling control and monitoring systems (for details of signalling system see Chapter 8). The system also provides the `camera-ready' artwork for the printer to produce the final working timetable.

Availability of lifts and escalators

14.63. The DTp target for lifts and escalators to be achieved by April 1992 is as follows:

> The availability of escalators as a percentage will improve from 78 per cent to 86 per cent and for lifts from 75 per cent to 85 per cent. Escalators will achieve 95 per cent of planned in-service time and lifts will achieve 90 per cent (excluding 1908 models).

The second part of the target is designed to allow for the effect of major repairs and replacement.

14.64. Business Goal 2 is also relevant (see paragraph 8.126):

> An escalator service to meet customer expectations by April 1991. This means no more than 35 escalators out of service for any reason. Emphasis is to be placed on minimising the downtime of individual machines.

14.65. The performance figures are derived from LUL's records of lift and escalator availability, which are based on the proportion of total hours that facilities are available. There are 70 lifts (of which eight are 1908 models due for early replacement) and 274 escalators. The information shows the number of machines out of service due to replacement, maintenance or failure. Quarterly performance compared with the 1988/89 base year and the target is reported in the four-weekly LUL Business Report. Recent performance is shown in Table 14.12. Lift and escalator maintenance and renewal methods are discussed in Chapter 8.

TABLE 14.12 **Lift and escalator availability**

per cent

	Average 1988/89	*Average 1989/90*	*Quarter 1 1990/91*	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target*
Lift availability						
As percentage of total traffic hours	75	85	89	89	91	85
As percentage of planned in-service time	87	94	95	95	96	90
Escalator availability						
As percentage of total traffic hours	78	76	81	84	85	86
As percentage of planned in-service time	88	91	92	95	95	95

Source: LUL.

14.66. Overall lift availability has improved from 75 per cent in 1988/89 to 91 per cent in quarter 3 of 1990/91, comfortably in excess of the 85 per cent target. Overall escalator availability has also increased from 78 per cent in 1988/89 to 85 per cent in quarter 3 of 1990/91. Although this is still short of the 86 per cent overall availability target, there is a strong upward trend and the target should be achieved as further replacement and major repair projects are completed, unless performance is affected by economy measures. LUL is still well short of meeting its own Business Goal 2 target of a maximum of 35 escalators out of service: 43 were out of service in period 11. The trend is, however, downwards as the number of escalators being replaced or maintained is reduced. Although a number of replacement projects have now been completed there were still 20 escalators being replaced in period 11.

14.67. Table 14.13 shows customer survey results produced for LUL. The satisfaction rating (see footnote to paragraph 14.31) for `ease of getting to/from platforms' shows some steady improvement from a low base of 41 (out of 100) in the first quarter.

TABLE 14.13 **Customer satisfaction rating for `ease of getting to/from platforms'**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Satisfaction rating (out of 100)	41	42	44

Source: LUL.

14.68. LCCI was concerned about the number of escalators out of service and said that it had urged LRT to devote resources to this problem as soon as possible. LCCI was convinced that public display of the contractor's name and the estimated time of completion at sites where lifts and escalators were being repaired would act as an incentive to LUL and its contractors to ensure that work was completed on time. One London borough sought improvements to lifts for people with disabilities, although it recognised that such improvements would increase overall costs for LUL.

14.69. LRPC praised LUL's efforts to tackle the backlog of escalator and lift maintenance revealed by the Fennell Inquiry, and the speedy implementation of the report's recommendations. However, LRPC commented that it had raised the problem of deterioration in lift and escalator services with LUL repeatedly since 1984 relating to replacement of wooden panelling, enhanced cleaning standards and the installation of heat and smoke detectors.

14.70. DTp said that the reliability of escalators and lifts was a particular problem, but it acknowledged LUL's success in improving the quality of service available from its essentially antiquated system.

Station environment and cleaning

14.71. The DTp target for station cleanliness is as follows:

> The public perception of station cleanliness will be raised up to the standard achieved at the stations recently intensively cleaned.

14.72. Business Goal 3 is also relevant (see paragraph 8.170):

> A welcoming and customer-friendly environment by April 1991. This has implications for cleanliness, staff presence and attitudes, technology and policing.

14.73. For the purposes of the station cleanliness target passengers are interviewed every quarter at a random sample of stations throughout the Underground, to determine the proportion of people rating station cleanliness as adequate or better. This is then compared with results previously obtained at a group of intensively cleaned stations. Achievement of the target requires that at least 85 per cent of passengers surveyed rate station cleanliness as acceptable or better.

14.74. Table 14.14 shows recent performance compared with the station cleanliness target. The regular customer attitude surveys carried out for LUL include a wider range of satisfaction indices (see footnote to paragraph 14.31), including satisfaction with the cleanliness of stations.

TABLE 14.14 **Station cleanliness**

per cent

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target*
Percentage of passengers rating stations as acceptable or better	78*	78	83	85

Source: LUL.

*Data for last four weeks of quarter only.

14.75. The customer surveys measuring performance against the DTp target for quarter 3 of 1990/91 show 83 per cent of passengers rating station cleanliness as acceptable or better, only 2 per cent short of achieving the required standard. The satisfaction rating results also show an improvement in LUL's customer satisfaction rating for station cleanliness from 27 per cent in period 3 of 1990/91 to 36 per cent in period 10.

14.76. About 16 tonnes of litter are removed daily from the Underground, all of which has been deposited by passengers. LUL has significantly increased the amount of litter-picking to tackle this and has set enhanced cleaning specifications for its major stations. Cleaning contractors have also been introduced at many stations and the performance of the direct labour organisation has been improved.

14.77. LRPC told us that LUL's enhanced cleaning specifications for its major stations had been worthwhile, but on-train cleanliness and graffiti were still serious problems. LRPC had supported LUL's initiatives against graffiti and said that any relaxation of effort over this would give rise to widespread public disquiet. LCCI also welcomed the introduction of new paint surfaces to deal with graffiti.

14.78. LRPC said that bright, clean, well-lit and well-signed stations amply provided with seats, clocks, telephones and passenger information were an essential complement to the new or upgraded trains gradually coming into service. An attractive travelling environment increased passenger confidence and reduced anxiety. LRPC believed that station renovation work should proceed as quickly as possible. LRPC said that temporarily closing some stations while this work was in progress was unlikely to be acceptable in the case of any stations where no substitute existed in the vicinity. More should be done to inform passengers about the purpose and the likely duration of the work in progress.

14.79. LUL acknowledges the need to upgrade the environment of its stations and many improvement schemes have been implemented, particularly in the central area. After criticism of some of its modernisation schemes LUL is now more alert to the need to conserve examples of good design from earlier periods (see paragraph 13.31). In addition to environmental improvements LUL has recently turned its attention towards station capacity improvement. A major enhancement of the Angel station is under way and station capacity improvement schemes are being developed for King's Cross, Victoria, London Bridge, Tottenham Court Road and Holborn amongst others. Many of these schemes were identified as high priorities in CLRS and included in the MUP. They are, however, subject to delay for financial reasons.

14.80. In its submissions to us LRPC stressed the issue of improving access to the Underground for handicapped people, and made reference to an LUL proposal to create a `core' group of accessible stations. LUL is pursuing a number of initiatives aimed at improving access to the system and the passenger environment to assist people with disabilities. These include:

(a) the publication of a manual entitled *Making Underground Stations more Accessible to Passengers-Especially the Elderly and Disabled*;

(b) experiments with high-visibility markings on steps and escalator handrails to help partially-sighted people determine which are the `up' and `down' escalators;

(c) design criteria for both refurbished and new LUL rolling stock which take account of the needs of passengers with disabilities;

(d) the installation of prototype tactile surfaces on a station platform to indicate to blind people the inner edge of the standard concrete nosing stones; and

(e) the experimental use of a device which indicates to blind people which of the UTS gates is for entry and which for exit.

14.81. For the longer term, lifts between street level, ticket hall and platforms are considered for inclusion in all station redevelopment schemes. Similar facilities are envisaged for a network of `Core Stations' which serve the sub-surface District, Circle and Hammersmith, East London and Metropolitan Lines. Agreement has yet to be reached on the provision of funds to meet the substantial costs involved. The Jubilee Line extension will include lifts where necessary at all of its stations so that, subject to the final approval of the Railway Inspectorate, this new section of the network will be fully accessible both for the ambulant disabled and for people in wheelchairs.

Ticket purchasing facilities and UTS gates

14.82. The DTp target for ticket purchasing facilities is as follows:

> No more than 2 per cent of passengers will wait more than three minutes for their tickets. In addition 99.7 per cent of stations will on average have at least one form of ticket issuing facility available and 98 per cent of passenger operated machines will be available.

14.83. Waiting time figures are derived from regular surveys carried out at a sample of booking halls throughout the system. That part of the target relating to availability of facilities is based on information for all hours of operation from the UTS central computer.

14.84. Quarterly sampled performance is reported in the LUL Business Report. Recent performance compared with 1989/90 and the DTp targets is shown in Table 14.15.

TABLE 14.15 **Ticket purchasing**

per cent

	Average 1989/90	*Quarter 1 1990/91*	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target*
Passengers waiting more than 3 minutes for their ticket	3.2	3.1	2.5	1.2	2.0
Stations having at least one ticket-issuing facility available	99.4	100.0	100.0	100.0	99.7
Availability of POMs	N/A	98.6*	98.2	97.8	98.0

Source: LUL.

*Data for last five weeks of quarter only.

14.85. There has been a significant improvement in the passenger waiting time measure, which is now meeting its target, and at least one form of ticket-issuing facility is now consistently available at all stations. The availability of POMs is also very close to its target level. The success of UTS is enabling LUL to make savings by the early closure of some booking offices. The effect of this on the availability of ticket-issuing facilities will depend on whether high levels of machine availability are maintained.

14.86. Customer satisfaction survey ratings (see footnote to paragraph 14.31) for ticket purchasing and UTS gates are shown in Table 14.16.

TABLE 14.16 **Customer satisfaction: ticket purchasing and UTS gates**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Ease of using ticket machines	55	56	57
Ease of exiting through ticket barriers	37	42	45
Ease of buying tickets at offices	34	37	38

Source: LUL.

14.87. There are no DTp targets for UTS gate performance. Data on UTS gates out of service are shown in the LUL Business Report. The gates are proving to be reliable (95.6 per cent availability in period 11 of 1990/91) and are beginning to gain public acceptance: the ticket barrier satisfaction rating has improved from 37 per cent in quarter 1 of 1990/91 to 45 per cent in quarter 3.

14.88. ALA considered that the UTS ticket barriers were poorly designed, extremely unpopular, and did not seem to reduce fares evasion.

14.89. In its submissions to us LRPC commented that it was now satisfied that the gates have made a major contribution to reducing the queues and congestion of passengers exiting from stations, and that the gates have proved a valuable aid to controlling passenger flows and minimising the risk of potentially hazardous overcrowding.

Passenger information and assistance from staff

14.90. LUL now publishes timetables for all services. Most list all trains when the interval exceeds 10 minutes and summarise the service frequency at other times. The timetables are displayed at stations and are published in booklet form. Poster sites at stations, particularly in booking halls, are widely used to keep passengers informed about temporary alterations to services for engineering reasons and service developments. Pocket-sized editions of the Underground Journey Planner, together with information on Travelcards and other tickets, are available from stations and travel centres.

14.91. Information on changes to the train service, or the temporary withdrawal of facilities for engineering work, is provided to the public by means of posters at stations, car cards on trains, dot matrix platform indicators, press releases, letters to local residents and contact with entertainment organisations where travel could be affected.

14.92. LUL informs its staff of service problems through a broadcast system connecting the Headquarters control office with every ticket office and Station Operations Room. Additionally manual systems exist to provide local train service information to stations from the local signalman or from the information assistant in the Line Controller's office.

14.93. To provide this information to passengers there are dot matrix indicators on many platforms and PA systems on trains and at all stations. Station PA systems are connected to the Line Controller's office on all lines except the Victoria Line. Staff training is being provided to improve the quality of the announcements. Passengers are also informed about service delays by means of whiteboards at station access points. Information on service disruptions is also provided through national and local services.

14.94. Table 14.17 shows customer satisfaction ratings for LUL's public information. Passengers are satisfied with LUL's maps and signs but critical of PA systems both on stations and in trains.

TABLE 14.17 **Customer satisfaction: public information and staff**

	Satisfaction ratings (out of 100)		
	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Station signs and information	45	47	48
Train maps and information	53	54	54
Ease of hearing station PA	14	14	17
Helpfulness of station PA	17	18	20
Quality of train PA	11	9	12
Number of staff available	24	22	23
How quickly and sensibly staff react	27	26	25

Source: LUL.

14.95. Customer satisfaction with the helpfulness of station public announcements and their audibility, although improving slightly, remains low at ratings of 20 and 17 per cent respectively in quarter 3 of 1990/91. The quality of station signs and information achieves a more satisfactory rating of 48 per cent. Customers remain consistently dissatisfied (ratings of 23 and 25 per cent respectively) with the number and quality of Underground staff.

14.96. Two London boroughs complained about the lack of information for passengers when there were delays or breakdowns. One of these boroughs also commented that LUL's responsiveness to the public had been poor for years but was now improving.

14.97. LCCI supported LUL's intention to use a smaller, but better trained and more visible workforce, capable of dealing with day-to-day passenger problems and enquiries as well as having ready access to emergency assistance.

14.98. In its submissions to us LRPC commented that many complaints reaching it are addressed less to the inconvenience caused by service failures than to the annoyance arising from uncertainty about the situation. LRPC identified as a source of complaint the deficiencies in the exchange of information between operators which prevent problems from being made known in advance to passengers interchanging from system to system. LRPC also told us that any reduction in levels of station staffing was widely resented by passengers. In order to recover the confidence and goodwill of its passengers, LUL should endeavour to present a human face at all times. LRPC welcomed LUL's improvements in passenger information systems, including experiments with dot matrix signs and visual display units in ticket halls, but felt that there was still scope for considerable improvement. For instance, signs for non-English speakers should be provided, PA systems should be improved and the dot matrix indicators should be used to provide information about service problems.

Train cleaning

14.99. The DTp target for train cleaning is as follows:

> Carriages will be cleaned internally every service day, and externally every three service days except on the Circle and Hammersmith and the East London Lines which lack proper depot facilities.

14.100. Continuous computerised records of the proportion of trains swept internally during a 24-hour period and washed externally within the preceding three days are kept by the Stock Servicing Manager's staff at all depots where cleaning takes place.

14.101. Information on train-cleaning frequencies was not kept systematically until 1990/91. Performance since the beginning of the current financial year is shown in Table 14.18.

TABLE 14.18 **Train cleaning**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target*
Percentage of carriages swept every day	99.7	99.8	99.7	100
Percentage of carriages washed every three days	74.8	73.6	69.8	100

Source: LUL.

14.102. Table 14.19 shows the customer satisfaction survey ratings (see footnote to paragraph 14.31) for `cleanliness inside trains'.

TABLE 14.19 **Customer satisfaction: cleanliness inside trains**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Satisfaction rating (out of 100)	26	25	25

Source: LUL.

14.103. LUL aims to sweep each train at the end of each day at the depot and carries out litter-picking when services reach their terminals. Performance data show that over 99 per cent of trains consistently receive their daily sweep. Despite this, customer satisfaction with cleanliness in trains is consistently low, at a satisfaction rating of about 25 per cent. LUL is seeking to improve train cleanliness by the increased use of litter-picking during the service day.

14.104. In its submissions to us LRPC commented that on-train cleanliness remains a serious problem. It added that although trains are swept daily and cleaned more intensively monthly, rapid accumulations of litter still occur, and can remain untouched for many hours. LRPC suggested that there may be a case for sweeping-out at more frequent intervals and for more attention to be paid to the cleaning of train seats.

14.105. Only 67 per cent of trains were washed every three days in period 11 of 1990/91 and in no period of 1991 has LUL achieved an 80 per cent rating against this measure. LUL attributes the serious difficulties in even approaching DTp's 100 per cent target to shunting and operational restrictions associated with inappropriate siting of washing machines at some locations, together with excessive washing machine downtimes, particularly in very cold weather.

14.106. Graffiti are acknowledged by LUL to be a serious problem and they affect passengers' perception of the security of the system. LUL believes that the solution is improved depot security combined with painting trains with graffiti-resistant paint. Cash constraints are, however, likely to limit progress in this area.

14.107. LRPC has expressed its concern to us about the graffiti problem and fully supports LUL's policy of seeking to remove graffiti immediately when possible, to invest in surveillance equipment at appropriate sites, to adopt graffiti-resistant materials and colour schemes and to fund anti-vandal operations by the British Transport Police (BTP).

14.108. The Circle Line is particularly affected by graffiti and train-cleaning problems because it lacks proper depot facilities and there is no terminal at which litter-picking can take place. It is hoped that the introduction of modernised rolling stock in June 1991 will reduce the graffiti problem. Proposals to reorganise the combined pattern of services on the Circle Line and the Hammersmith and City Line are also being considered by LUL. These proposals would facilitate better internal cleaning by ensuring that Circle Line trains periodically visit a terminal.

Passenger security

14.109. The DTp has set LUL the following target:

> A reduction in the rate of violent crime on the Underground will be achieved.

14.110. For the purpose of this target violent crime covers the number of incidents of robbery and all types of assault within the network. The rate of violent crime is defined as the number of such incidents per million passenger journeys, based on records kept by BTP. This is compared with the rate for the 1988 base year, which was 3.0 reported incidents per million journeys.

14.111. Quarterly figures are reported in the LUL Business Report. Table 14.20 shows the performance compared with calendar year 1988, which is taken as the base year.

TABLE 14.20 **Rate of violent crime**

	1988	*Average 1989/90*	*Quarter 1 1990/91*	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target*
Violent crimes per million passenger journeys	3.0	2.4	2.0	1.9	1.8	<3.0

Source: LUL/BTP.

14.112. For its internal monitoring and control purposes LUL shows a more detailed analysis of all crimes compiled from BTP records in its four-weekly Business Report.

14.113. Table 14.21 shows the breakdown by type of incident.

TABLE 14.21 **Breakdown of types of crime: number of incidents**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3* 1990/91*
Theft from person	1,919	1,999	1,674
Theft from vehicle	361	324	278
Criminal damage	398	464	454
Violent crime	400	364	368
Drugs	30	19	25
Other	737	978	891
Total	3,845	4,148	3,690

Source: LUL/BTP.

*Calendar quarters (as opposed to LUL accounting quarters used elsewhere).

14.114. LUL and BTP have achieved a substantial reduction from the 1988 level of violent crime and the quarterly data continue to show a steady reduction. Effort has been directed at specific problem areas (such as the southern end of the Northern Line), with considerable success. Despite this the customer satisfaction surveys show a static 39 per cent rating for `safety from assault' and customers rank this issue

fourth out of 22 factors in order of importance. The survey data show that women are particularly concerned about their security.

14.115. In its submissions to us LRPC commented that the reduction in the rate of violent crime in each successive quarter since the end of 1988 was a considerable and very welcome achievement. LRPC added, however, that many passengers were profoundly disquieted at the absence of visible staff in stations, as a source of information or help, and as a reassuring symbol of authority. This finding also emerged in the report of a joint study by DTp, the Home Office, LUL and BTP, `Crime on the Underground', in 1986. ALA said that, despite the relative safety of the Underground, there was fear about security and many people, particularly women, perceived it as unsafe.

Safety

14.116. Following the King's Cross fire, in 1988 the Fennell Inquiry investigated LUL's fire safety performance in stations in great depth. Severe shortcomings were identified both in LUL's approach to safety and in its management approach generally. The Railway Inspectorate subsequently carried out a very thorough and urgent survey of LUL's safety management. Of the 157 recommendations in the Fennell Report 127 required action by LRT or LUL. LUL's response to the Fennell Report and other safety issues is considered in more detail in Appendix 2.2.

14.117. The implementation of the Fennell recommendations is part of a safety action programme covering all areas of the Underground. This also includes action resulting from an internal safety study and from the report by Sir Anthony Hidden QC into the Clapham Junction, BR accident, published in 1989. Many of the recommendations of the Hidden Report also apply to LUL's signalling and control systems.

14.118. Since the King's Cross fire it has been LUL's policy to call the fire brigade immediately any report of fire or smoke is made. New procedures for recording and analysing fires have been implemented and the detailed management information which these produce is being used to identify measures to reduce the incidence of fire on the Underground.

14.119. The very substantial investment in safety-related projects has been considered in Chapter 11. A systematic approach to risk assessment has been adopted and this will increasingly be used to determine the priorities for investment in safety improvements. The LUL Board recently asked a team led by Mr Vogel, one of its members, to investigate the effect of the budget reductions on safety. Their report concluded that although there was no immediate threat to safety standards there would be some cause for concern if the current level of financial stringency continued into 1992/93. It also identified some areas of concern which led the Board to implement budget changes. DTp acknowledged that LUL's plans to improve safety had been dominated by the recommendations of the Fennell Report. LRT/LUL had so far implemented over three-quarters of the recommendations directed to them.

14.120. Table 14.22 shows recent data demonstrating an increase in the numbers of reported fire and smoke incidents since 1989/90. After the peak in quarter 2 of 1990/91 recent periods show a downward trend.

TABLE 14.22 **Total fire and smoke incidents**

	Average rate 1989/90	*Quarter 1 1990/91*	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Number of incidents reported per four-week period	395	485	575	475

Source: LUL.

14.121. Each of these incidents involves attendance by the fire brigade and often results in significant delays to the train service, particularly when tunnels have to be searched for non-existent fires. With the number of incidents amounting to about 16 per day this seriously impairs the quality of the train service. Table 14.23 shows a breakdown of the types of incident occurring in period 11 of 1990/91 and Table 14.24 shows a further analysis of the 370 `category C' incidents shown in Table 14.23. In nearly 83 per cent of cases no fire was found and fewer than 6 per cent required action by the fire brigade.

TABLE 14.23 **Analysis of fire and smoke incidents in period 11, 1990/91**

Number of incidents, period 11

	Category A, dealt with by fire brigade	*Category B, dealt with by LUL staff*	*Category C, no fire found*	*Total*	*Percentage*
Station	0	6	212	218	48.8
Lifts and escalators	0	1	29	30	6.7
Track	14	34	55	103	23.0
On/under trains	6	7	58	71	15.9
Other	6	3	16	25	5.6
Total	26	51	370	447	100
Percentage	5.8	11.4	82.8	100	

Source: LUL.

TABLE 14.24 **Analysis of category C incidents (no fire found) in period 11, 1990/91**

	%
Automatic alarms going off for no apparent reason	30
Other equipment failures or external causes	32
Hoax or suspect hoax calls	12
No cause found for alert	26
Total category C	100

Source: LUL.

14.122. LFCDA was concerned that the ability of LUL fully to implement the requirements of the Fire Precautions (Sub-Surface Railway Stations) Regulations 1989 should not be hindered by any recommendations arising from our inquiry.

14.123. In its submissions to us LRPC commented that the attendance of the fire brigade whenever fire or smoke was reported on the Underground had become a major source of service disruptions. Although LRPC understood the fire brigade's insistence upon being called on every such occasion, it felt that the repercussive effects of such attendances were liable to be widespread and prolonged. LRPC felt that over-sensitive new smoke detection equipment was partly responsible for the increase in the number of false alarms. LUL told us that it was aware that smoke detectors were liable to give spurious alarms and that it was examining ways to minimise the problem. This included, at one extreme, the possibility of removing smoke detection equipment once all the other fire safety systems had been installed.

Conclusions and recommendations

Total Quality programme

14.124.*(a)* LUL acknowledges that its traditional corporate culture was inconsistent with a high quality of customer service. A Total Quality programme has been adopted as the means of changing this corporate culture and becoming a market-led business. As the Total Quality programme has yet to reach most front-line staff it is too early to comment on its degree of success.

(b) We conclude that LUL's Total Quality programme is a welcome initiative. It should lead to an increased emphasis on customer service when it is extended to cover all front-line staff. The programme also has the potential to increase the involvement of all staff in developing proposals for improving operating methods and the quality of service.

General performance measures

14.125.*(a)* In Chapter 4 we have considered LUL's financial performance indicators. In this section we deal with the quality of service performance indicators only. A series of quality of service performance indicators was agreed between LUL and DTp in 1989. Targets were set, for each indicator, and LUL was expected to achieve these by April 1992. The indicators cover various aspects of the train service, facilities at stations, cleanliness and passenger security. The targets are challenging and in most cases will require significant management action for LUL to achieve them. On past trends most targets are capable of achievement. Economies taken in response to the present financial crisis may, however, affect performance adversely and prevent some targets from being met.

(b) We conclude that the setting of targets by DTp is welcome and that they have in the main been set at a realistic level.

(c) The DTp targets cover many aspects of the train service and services generally. They do not, however, cover all aspects of quality of service. There are, for example, no targets for crowding or for the frequency and duration of major disruptions to the train service. LUL has established a wide range of performance indicators for its own internal use and has included measures of customer satisfaction amongst them. LUL has, however, found that the wide range of DTp indicators and its own internal performance indicators are too diffuse to act as a focus for its drive to improve quality of service. It has therefore supplemented them with four Business Goals directed at achieving rapid improvements in key areas of performance.

(d) We conclude that the coverage of the DTp performance indicators needs to be reviewed. We therefore recommend that LUL should initiate discussions with DTp with a view to establishing revised performance indicators before April 1992.

(e) We also conclude that the introduction of regular measurements of customer satisfaction by LUL is a welcome step. We recommend that in reviewing the DTp performance indicators LUL and DTp should give attention to measures of customer satisfaction and service output as well as measures of input.

(f) We further conclude that the four Business Goals are a welcome attempt to focus the attention of management and staff at all levels on key aspects of quality of service. We therefore recommend that LUL should extend this approach and set itself quantified key goals for achievement each year. We also recommend that these goals should be publicised and performance against them used to demonstrate changes in the quality of service to LUL's customers.

Train service

Mileage operated

14.126.*(a)* LUL is well short of the DTp mileage operated target, particularly in the peak periods, when only 92 per cent of scheduled miles are run. Reduced train availability caused by rolling stock maintenance and design problems is a contributory factor to poor performance on several lines.

(b) The mileage operated performance indicator has to be interpreted with care since a reduction in the scheduled mileage results in a spurious `improvement' in performance. This has happened recently on the Victoria Line, where schedules have been reduced to take account of the limited train availability caused by wheel wear problems.

(c) There are strong variations between the lines, largely caused by technical problems. The Northern Line management team has, however, achieved a notable increase in its mileage operated over the last year by management action, in particular by careful attention to tackling the causes of train non-availability and staff absence (see paragraph 8.188).

Reliability and punctuality

14.127.*(a)* LUL's train service is well below the DTp targets for reliability and punctuality. There is also no trend in its performance over the last seven quarters. The underlying reasons for the failure to achieve these targets are related to the same train availability problems which restrict the mileage operated.

(b) The reliability and punctuality indicators do not fully reflect the effect of major disruptions to the service, since a major disruption is likely at most to be sampled as a single event. The customers' view of the reliability of the train service is, however, heavily influenced by the major disruptions caused by factors such as the substantial number of fire alarms and station closures when the fire brigade is called.

(c) We conclude that a measure related to the extent of major disruptions to the service is needed. We therefore recommend that LUL should propose a suitable measure related to the number of disruptions to service on each line in excess of 15 minutes and to their average duration. We also recommend that in reporting progress against this measure LUL should identify the major causes of service disruptions, the extent to which these are within the control of management and the action that it is taking where possible to reduce them.

14.128.*(a)* The DTp performance measure for reliability is based on the number of passengers waiting more than 1.5 times the scheduled interval for a train. For internal purposes LUL uses simpler measures such as average waiting times or excess waiting times.

(b) We conclude that there is a strong case for a simpler measure of waiting times which can be regularly reported to the passengers on each line. We therefore recommend that from September 1991 LUL should publish regularly every four weeks the average morning and evening peak, and off-peak, waiting times for each line in the preceding period compared with the scheduled service intervals.

Peak capacity and crowding

14.129.*(a)* LUL was set a target of increasing its peak services by 5 per cent, compared with the 1988 base year, with a view to reducing crowding on the system. Performance shows an overall increase in peak capacity, but this is less significant than the wide variation between the lines. Peak capacity has declined on some of the lines most affected by crowding, including the Central and Victoria Lines, mainly on account of the rolling stock availability problems discussed above. This decline has been more than offset by increases in peak services of over 18 per cent on the East London, Jubilee and Bakerloo Lines.

(b) We conclude that the peak capacity target has failed to meet its objective of reducing peak-hour crowding. We therefore recommend that if an increased peak capacity target is set in future, separate figures should be set for each line related to its level of overcrowding and the technical capacity constraints on the line.

14.130. *(a)* At present there is no DTp target for reducing crowding even though reducing overcrowding was a prime objective of CLRS. Despite the problems in measuring crowding LUL has developed its own internal measures based on sampling peak trains.

(b) We conclude that there is a case for a target directly related to the peak crowding on each line. We recommend that LUL should put forward proposals for such a measure for consideration in the overall review of targets. This measure could be based on LUL's own internal sampled estimates of the probability of travelling on an overcrowded train in the peak period on each line.

14.131. *(a)* Whatever action is taken many parts of the Underground are likely to be severely affected by peak crowding, until major increases in capacity come on stream, if demand remains at or above present levels. Trends in demand show a steadily increasing number of passengers transferring from NSE to the Underground at the major interchanges even in present market conditions. This is aggravating station overcrowding problems that are already serious. Methods of managing crowding are therefore crucial. LUL has significantly improved its ability to prevent the development of dangerous conditions by controlling crowds at stations and restricting access.

(b) We conclude that the improved methods of crowd control introduced by LUL are welcome but should not be regarded as a satisfactory long-term solution to the problem of controlling overcrowding. We therefore recommend that LUL should continue to develop further more advanced methods of controlling overcrowding, including methods of improving the regularity of services and restricting stop times in stations.

Overall quality of train service

14.132. *(a)* It is clear that many parts of the Underground system are close to technical capacity constraints. This results in the quality of service indicators being to some extent in conflict. LUL commonly finds that attempts to increase the frequency of a service reduce its ability to recover from any disruption and therefore reduce its reliability.

(b) We conclude that it is important that LUL strike the right balance between frequency and reliability bearing in mind the effect on overcrowding. We therefore recommend that LUL should make more systematic use of its TSM to simulate the effect of changes in service patterns, with a view to identifying the optimum pattern of service on each line by December 1992.

(c) We also recommend that in determining the balance between frequency and reliability the views of the passengers on each line should be a prime consideration and that LUL should have regard to the impact of any service changes on its measures of customer satisfaction with the train service.

(d) We further conclude that the increased level of overcrowding in the area bounded by the main BR interchanges may make some revisions to traditional patterns of service desirable. We therefore recommend that LUL should review whether revised central area service patterns, including the increased use of shuttles between main-line terminals on appropriate lines, should be introduced.

Passenger information

14.133. *(a)* LUL has taken significant steps to upgrade its passenger information by introducing dot matrix displays on platforms and by introducing new PA equipment. Advance information at station entry points is limited to white boards and much old unsatisfactory PA equipment is still in service. Further proposals to improve passenger information have been developed but are unable to proceed in the present financial climate.

(b) We conclude that further steps need to be taken to improve the information provided to passengers. We therefore recommend that LUL should continue to investigate measures such as dot matrix and VDU displays at station entry points, better advance warnings of service problems to NSE passengers and the further upgrading of PA systems at stations and on trains.

Station environment and cleaning

14.134.*(a)* LUL has made considerable efforts to improve the cleaning of its stations by introducing private contractors and upgrading the performance of its direct labour organisation. Performance against DTp's public perception cleanliness target shows significant progress.

(b) We conclude that LUL is likely to reach the DTp station cleanliness target and we welcome the improved cleanliness of stations.

Train cleaning

14.135.*(a)* Despite LUL's meeting the DTp target for the internal cleaning of trains, passengers remain highly critical of train cleanliness.

(b) We conclude that the present DTp target is unsatisfactory. We therefore recommend that the target should be replaced by an output measure based on sampled train cleanliness, or by a customer satisfaction measure.

14.136.*(a)* Since LUL is experiencing serious problems with its washing equipment for the external cleaning of trains it is falling well short of this DTp target.

(b) We conclude that this target cannot be met with present equipment and a less onerous target may be required until LUL has invested in improved cleaning equipment.

14.137.*(a)* Graffiti are a serious problem on the Underground since they affect the customers' perception of their security. LUL has begun to tackle this problem by improving depot security and by painting trains with graffiti-resistant paint. The speed of implementation is, however, likely to be very limited in the present financial situation. There are particular problems concerning train cleaning and graffiti on the Circle Line, which has inadequate depot facilities and no terminals at which litter-picking can take place. LUL has developed proposals for combining the operation of the Circle and Hammersmith and City Lines which would alleviate this problem without significantly changing the frequency of train services provided.

(b) We conclude that the problem of graffiti remains serious and that it is unlikely that LUL can resolve the Circle Line's particularly serious cleaning and graffiti problems within the present pattern of service. We therefore recommend that LUL should give priority, as funds permit, to measures such as improved depot security and the painting of trains. We also recommend that LUL should bring forward the proposals it has developed for revising the joint pattern of service on the Circle and Hammersmith and City Lines to enable more satisfactory cleaning to take place.

Passenger security

14.138.*(a)* Although LUL and BTP have achieved a significant reduction in the rate of violent crime on the Underground, this is not reflected in any improvement in the public perception of their security. Measures taken to reduce the level of crime at the southern end of the Northern Line have been particularly successful. Passengers still consistently express the view that they would like to see a larger number of more visible, better trained staff on the Underground. The success of UTS is enabling LUL to make savings by reducing the number of booking office staff. LUL also has plans to make limited reductions in the

number of front-line station staff outside the booking offices. Although LUL intends to increase their effectiveness by providing them with improved equipment, this may cause concern to some passengers.

(b) We conclude that the reduction in the level of violent crime is welcome and that this achievement of LUL and BTP should be more widely recognised. We recommend that LUL should continue its joint efforts with BTP to improve passenger security and extend the successful crime prevention initiative taken at the southern end of the Northern Line. We also recommend that LUL should take further steps to publicise the reduction in the level of violent crime that it has achieved.

(c) We also conclude that the number of front-line station staff outside the booking offices should not be reduced, particularly in high-crime areas, before BTP's views on the staffing levels and equipment proposed for each station have been taken into account. We therefore recommend that LUL should consider in detail, jointly with BTP, the implications of any such proposed reductions and should closely monitor any resulting effects on its passenger satisfaction measures at the stations concerned.

Safety

14.139.*(a)* The King's Cross fire revealed a poor safety management situation at LUL. LUL has, however, taken decisive and effective action to rectify this and to implement the numerous safety recommendations and regulations resulting from the Fennell Report, the Hidden Report, the Railway Inspectorate's report and the Fire Precautions (Sub-surface Railway Stations) Regulations 1989. LUL has also adopted a scientific approach to risk assessment to help it to establish the priorities for action.

(b) We conclude that LUL should be commended on the decisive action it has taken to improve its standard of safety management, in particular by introducing the stringent ISRS Safety Management System (see Appendix 2.2) and by adopting a scientific approach to risk assessment.

15 Summary of recommendations

In this chapter we summarise our recommendations. We set out in bold type those which we believe should have priority; they relate to the priorities identified in paragraph 1.47.

Recommendation no		*Paragraph no*
	Management and organisation, and planning	
1.	LUL should review the Headquarters structure with the aim of reducing the spans of control to below double figures. A start has been made, in the case of the Managing Director, as part of a value analysis review.	3.78
2.	LUL should take steps to clarify responsibility and eliminate duplication, particularly in regard to core business activities, and this should be done by October 1991.	3.80
3.	LUL, in conjunction with LRT, should devote more attention to reconciling its business strategy with other aspects of the overall transport strategy for London. This may require consultation with other public transport bodies followed by joint lobbying to establish a common view on the role of LRT, shared with the Government and the wider public.	3.83
4.	LUL, in conjunction with LRT, should put forward proposals to establish a clear framework of objectives for agreement by DTp by the end of 1991.	3.86
5.	LUL should now prepare a new strategic plan and seek firm political commitment to this plan. The plan should include a range of costed options covering levels of fares, investment and financing, and showing the implications of these for the quality of service and for the long-term development of London's overall transport system.	3.88
6.	The line business plans should become an integral part of the LUL Business Plan in the next annual planning cycle. Line proposals should then be drafted on the basis of general guidelines and realistic financing limits set from the centre. Similarly the analysis of the line programmes in the UIP should receive the same degree of emphasis as the analysis by engineering client programme.	3.89
7.	LUL should take steps to identify the best practice in the existing line business plans and to incorporate this within the central guidelines for future plans.	3.90
8.	LUL should base the main case of its next Business Plan on a core level of financing in which it has a high level of confidence, and should include one or more higher cases with additional projects related to the	3.91

scenarios being developed for the UIP (see paragraphs 11.77 and 11.78).

Financial framework and control

9.	**LUL's budget and five-year business plan should reflect a consistent and integrated route to the achievement of long-term objectives and should be agreed with DTp.**	**4.83**
10.	A rearrangement of present procedures should be introduced to permit flexibility to cover expenditure phasing variations; in particular, spend earlier than the original phasing could be met from the following year's EFL where this is greater than the one percentage tolerance; greater use should be made of temporary borrowing powers; and delayed spend covered by advances placed on deposit with the National Loans Fund or elsewhere in the public sector for subsequent draw-down.	4.84
11.	**Responsibility for the monitoring of cash overspends and bringing these to the notice of the individuals responsible and for the management and control against the grant should be firmly placed on LUL's Finance Director, who should nominate one specific individual to monitor and control all the elements comprising the EFL.**	**4.85**
12.	The budget preparation start date should be aligned with the EFL announcement and the five-year plan should be started at a date much closer to the IFR bid timing.	4.87
13.	**LUL's new Finance Director should give the very highest priority to the imposition of effective cash controls and management to be in place by 30 June 1991.**	**4.90**
14.	Monthly cash flow statements should be produced to show: *(a)* the cash flow from operating activities; *(b)* the cash flow from investing activities (basically capital expenditure); *(c)* the cash flow from financing activities; *(d)* the net decrease/increase in cash and cash equivalents; *(e)* the cash and cash equivalents at the beginning of the period; and *(f)* the cash and cash equivalents at the end of the period. The figures should be in sufficient detail to show how the individual totals have been arrived at. Annual statements should also be produced and show the figures (estimated and actual) which formed the EFL for the year in question and be included in LUL's (and LRT's) published accounts.	4.91
15.	Operating surpluses, both before and after charging depreciation and renewals, should be expressed in relation to passenger miles and passenger journeys from 1 April 1991 onwards.	4.93

16. LUL's use of costs per train mile as a measure of efficiency, and for one of its financial targets, should be supplemented, with effect from 1 April 1992, by a variety of measures related to other important operational characteristics such as numbers of employees and/or value of assets employed. 4.94

17. A full review of asset lives and the resulting depreciation rates should be undertaken in 1991/92 and should specifically take account of the need for a closer correlation with economically optimal replacement cycles, backed by rigorous financial/economic analysis, and of prospective technological developments in so far as these can be foreseen. 4.95

18. With effect from 1 April 1991 the charge for renewals of non-depreciable assets should be placed on a similar basis to that used for depreciation. 4.96

19. In conjunction with a user-led review of MIS a critical review should also be undertaken of LUL's budgeting, accounting and costing systems and the extent to which they should, or should not, be devolved to business units. This should take place in 1991/92. 4.97

20. Such a review should examine, *inter alia*, the possible use of, and scope for, flexible budgeting, eg for line activities, and standard costing for engineering workshops. 4.98

21. LUL should undertake an immediate review of its intra-business charging system with a view to its simplification. 4.99

Management information systems

22. The ITSG should be strengthened, and this enhanced role should include user sub-groups covering particular functional or business areas, eg line businesses or depots. These user groups would have the remit of setting software specifications and user acceptance testing. 5.38

23. An urgent review of MI reports should be carried out with the objectives of: **5.39**

(a) **reducing the volume and number of reports;**

(b) **focusing on a better digested and action-orientated presentation of the key items of performance data;**

(c) **ensuring that information is produced within a time-scale which enables corrective action to be taken effectively;**

(d) **improving and standardising the presentation of information by making better use of graphical presentation and exception reporting;**

(e) **spreading the best practice in report presentation amongst the business units; and**

(f) **ensuring that detailed numerical data are distributed only where needed.**

The users of the reports should be closely involved in reviewing their content and this review should be completed by October 1991.

24. **The above review should specifically take account of the need for more financial information, including financial measures and efficiency ratios.** **5.40**

25. LUL should extend the capability of EIS as rapidly as the underlying databases permit and make it available to managers at all levels as needed. In doing this LUL should examine the experience of the Central Line with its on-line database to determine the most cost-effective way forward. 5.41

Manpower and industrial relations

Industrial relations, pay and employment policies

26. LUL management and the trade unions should make a concerted effort to agree new bargaining and consultation machinery which is appropriate to the structural changes which have taken place in LUL. In the event of continuing disagreement the parties should agree to a reference to ACAS. 6.44

27. LUL should continue its efforts to simplify the existing pay system. 6.45

28. Bonus and incentive schemes for wages grade staff should be reviewed jointly with the trade unions with the aim of simplification and of providing incentives to complete more work. 6.45

29. LUL should consider devolving the recruitment of wages grade staff to local business units having due regard to costs and benefits. 6.46

30. The provision of a new vocational training centre is important and should be proceeded with as soon as finances allow. 6.47

31. Training courses for outside organisations should be priced competitively. 6.47

32. Statistics to assist the monitoring and control of absence and labour turnover should be available to all managers, together with training both in counselling skills and in the application of LUL procedures for dealing with unsatisfactory attendance. 6.48

Efficient use of manpower

33. **An in-depth examination of manning levels and responsibilities in the central directorates should be undertaken by September 1991 as part of the value analysis initiative.** **7.58**

34. An independent outside review of LUL's accounting staff requirements should be carried out, having regard to the financial and accounting tasks which need to be undertaken, as soon as devolution is in place and not later than 1992/93. 7.58

35. Overtime, particularly unrostered overtime, should be monitored and controlled more effectively and action taken by the end of 1991 to identify the components of wages drift. 7.58

36.	The development of RPIS should be continued so that all relevant personnel data essential for manpower planning purposes are readily available to managers throughout LUL by mid-1992.	7.59
37.	**LUL, through the value analysis initiative and local management, should examine thoroughly the scope for further staff savings and efficiency gains, for example in the area of flexible rostering for train staff.**	**7.60**
38.	**LUL should enter into negotiations with the trade unions over those items currently in collective agreements which may constrain productivity.**	**7.60**
39.	**The LUL productivity target improvement of 2 per cent each year on average over five years, which we note and consider to be reasonable, should be seen as a minimum target to be achieved.**	**7.60**
40.	LUL should pursue a policy of increasing competition in all areas where external contractors are competent to tender for work and can operate within LUL-defined and controlled safety standards.	7.61

Operational capacity and management of existing resources

Rolling stock maintenance

41.	**LUL should take urgent action to improve the provision of proper instruction manuals and the setting of clear quality standards by autumn 1992.**	**8.172**
42.	**LUL should make greater effort in undertaking failure analysis involving the R&D unit in order to identify the real causes and what modifications to equipment or methods are required.**	**8.172**
43.	By October 1991 LUL should take steps to strengthen the night staff available for casualty work.	8.173
44.	**By October 1991 LUL should undertake a detailed review of the costs and benefits resulting from introducing two-shift or three-shift working at depots.**	**8.173**
45.	LUL should review its schedule of planned maintenance in order to relate it more closely to actual needs by autumn 1992.	8.174
46.	As part of the current value analysis review LUL should examine planned maintenance turnround times to ensure that they are appropriate to the work content using best practice by spring 1992.	8.175
47.	LUL should install control procedures to monitor and report depot performance against planned intervals and turnround times by spring 1992.	8.175
48.	Trains should not be withdrawn from service prematurely to queue for planned maintenance; and casualties approaching a planned maintenance activity should undergo that activity immediately, using casualty facilities if necessary.	8.175

49.	Only major modifications should be considered for incorporation by the TMU; minor modifications should be undertaken by depots.	8.176
50.	Major modification work should be subject to, as far as possible, competitive tenders.	8.176
51.	LUL should assign clear responsibility and targets to depot staff for managing the incorporation of modifications and line businesses should take a more positive approach to ensuring that their responsibility is fulfilled.	8.176
52.	LUL should review its system of categorising modifications in order to ensure that appropriate priorities are applied to their incorporation.	8.176

Other maintenance

53.	LUL should seek ways of accelerating its current 15-year programme for improving track quality (perhaps to the ten-year programme proposed by the Permanent Way Engineer), giving particular attention to lines about to receive new rolling stock.	8.177
54.	**Urgent attention should be given to improving working methods for maintaining the permanent way, the development and provision of more effective tools and equipment and the use of external contractors to provide increased resources.**	**8.178**
55.	LUL should ensure that programmes are established for the adequate cleaning, maintenance and upgrading of lifts and escalators; and that the work is planned and controlled to minimise the downtime of individual machines.	8.181

Management of existing resources

56.	LUL should ensure that the action taken by Northern Line management to reduce train cancellations is applied on other lines where appropriate by October 1991.	8.188
57.	LUL should review its arrangement for dealing with equipment failures in service in order to achieve a more rapid response.	8.191
58.	LUL should continue to examine the potential for more effective regulation of station stop times.	8.191
59.	LUL should implement the findings of its own review of emergency procedures following the recent Central Line incident as a matter of urgency, and should consider whether the present rules and regulations governing emergencies are appropriate in all likely circumstances.	8.193

Matching services to demand

60.	Basic passenger counts should be extended to cover all hours of operation from autumn 1991.	9.55

61.	LUL should measure the variability in passenger volumes, with a view to taking into account in its planning process the probability of abnormally high flows.	9.56
62.	In conjunction with LRT, LUL should carry out more frequent O-D surveys and should evaluate the case for extending the station exit counts to all stations in order to offer an additional control for updating data from other passenger surveys.	9.57
63.	LUL, in conjunction with LRT, should explore ways in which UTS gate data could be used.	9.58
64.	LUL should adopt a more critical approach to revenue estimation and should undertake systematic risk analysis to expand on its sensitivity tests.	9.60
65.	LUL should base its decisions on the level of service it provides using the same criteria for effects on operating costs as for capital expenditure.	9.64
66.	LUL should undertake an annual review of all investment and operating expenditure that affects capacity in order to ensure that the balance between expenditure in different areas is appropriate.	9.66
67.	LUL should regularly review its operating activities to ensure that all its service levels on trains and stations are fully justified by demand.	9.68
68.	An analysis of the costs and benefits involved with services at the margins of the operating day and at weekends should be conducted every two years and the first such analysis should be completed within one year.	9.69

Fares

69.	**LRT should agree and by the end of 1991 publish a revised statement of its fares policy.**	**10.58**
70.	**LRT and DTp should consider establishing a long-term contractual relationship based on the review, discussion and approval of LRT's strategic plans. This contract should include an agreement on the level of annual real fares increases which will be permitted to LUL during the period of the Strategic Plan and the formula by which such increases will be calculated. If DTp were then to decide that a different policy in respect of LRT's fares were more appropriate, LRT should receive a compensatory grant to make up for any resulting shortfall in funds. If possible, agreement on such a contract should be completed prior to the publication of LRT's next Strategic Plan.**	**10.60**
71.	LRT should be given greater freedom to alter individual fares within any agreed average overall percentage increase for all fares.	10.62
72.	LUL should institute a regular system for estimating costs by section of line and time of day as part of its ongoing management information. This system should be introduced within one year from publication of this report.	10.65

73.	LRT should carry out an in-depth review of the merits of the present zonal fares system and whether it would be better to replace it with a system which more closely reflects the costs of each individual journey made.	10.67
74.	LUL needs to consider more carefully the relative cost of providing peak and off-peak services and whether fares are appropriately structured to reflect such cost differences. After due consideration and analysis LUL may wish to introduce a revised fares structure which takes into account more directly the relative costs of providing peak and off-peak services.	10.69
75.	LUL should undertake a review to assess the effect of Travelcard on demand during the evening peak within 18 months.	10.72
76.	The Travelcard product should be retained. As Travelcards appear to offer particularly good value for money there may be a case for increasing their price relative to ordinary single tickets. However, any decision to increase the relative price of Travelcards should be dependent upon the revised statement of LRT's fares policy (see paragraph 10.58) and should not be introduced until that statement has been agreed and published.	10.74
77.	LRT and BR should continue their efforts to reach a mutually satisfactory agreement on the distribution of Travelcard revenue. If they cannot do so DTp should be prepared, if necessary, to determine what it considers to be a fair distribution of Travelcard revenue and instruct the two companies accordingly. LRT should not introduce its own ticket just because it could not reach agreement with BR on the distribution of Travelcard revenue between the two organisations.	10.76
78.	LUL should be encouraged to examine further the potential for SVT.	10.78

Investment

79.	**The UIP for future years should be based on the scenario approach for the Underground system proposed by LUL and should spell out the implications of different levels of funding, including the interrelationship between projects and the effect on the achievement of Business Goals.**	**11.78**
80.	LUL should measure its out-turn expenditure in the UIP against its priorities and objectives and should analyse the benefits achieved from completed projects in terms of these priorities and objectives.	11.81
81.	LUL should, within the next UIP, make more systematic use of information on cost benefit ratios and the financial impact of projects in arriving at its project priority ranking.	11.84
82.	LUL should ensure that a full risk assessment in the appraisal of safety projects is in place by 1992.	11.86
83.	**LUL in its investment appraisal should:**	**11.89**

(a) **include the cost of delaying a project; and**

(b) **develop more options to take account of possible funding constraints.**

84. The base for assessing projects should be the cheapest way of maintaining an existing quantity and quality of service. Where modern equivalent assets are used they should be shown to be the cheapest option or other cheaper options should also be evaluated. 11.92

85. LUL's sensitivity analysis of projects should include all the following sensitivities for projects over £2 million and those considered most appropriate for smaller projects: 11.95

(a) sensitivity analysis for all benefits, based on a realistic assessment of the likely error, particularly where the calculation is subject to a high level of uncertainty, as in the case of passenger benefits;

(b) sensitivity analysis of all costs based on the estimated reliability of the cost data;

(c) sensitivity on the main underlying assumptions including, where modern equivalent assets are used, sensitivity on the value of modern equivalent assets and the assumed time when they will be replaced; and

(d) sensitivity analysis of a combination of factors, especially where factors are likely to vary together, including where possible the probability of such variations.

86. LUL's Finance Directorate should expand its Client Manual to include more detailed advice on project appraisal, building on that provided by the Development Directorate's Train Service Development section by December 1991. This should also include advice, to be regularly updated, on best practice and the lessons learned from previous project appraisals and the various reviews of these projects. 11.98

87. LUL should, in its discussions with DTp, pursue the establishment of a way in which passenger benefits could be reflected in pricing policy. 11.101

88. LUL should have a means of directly linking the UIP with the quality of service to show the effect of different levels of funding and mixes of project on the service level in time for the 1992 UIP. 11.104

89. By the end of 1992 LUL should have in place full information on depreciated assets, and on all other assets by the end of 1993, covering their age, maintenance expenditure and failure records along with the analytical tools necessary to calculate optimal maintenance and renewal policy taking account of costs, of revenues and of passenger benefits. **11.107**

90. LUL's maintenance and renewal policy for assets should balance increases in expenditure on maintenance, or earlier replacement, or both, against the likely change in revenue and passenger benefits through, for example, increased reliability. This would involve the measurement of whole-life costs and benefits. Account should also be taken of the interrelationship between assets, such as the effect of the permanent way on rolling stock maintenance costs and the expected life and reliability of the rolling stock. 11.107

Project management

91.	LUL should institute a formal training programme for business clients by April 1992 and produce a comprehensive business client manual before that date.	12.30
92.	**LUL should establish a mandatory quick review procedure for major overruns or overspends by October 1991.**	**12.39**
93.	**LUL should categorise and monitor the cause of overruns on a regular basis by October 1991.**	**12.39**
94.	**LUL should consider the use of individually set control criteria according to the size or type of project by October 1991.**	**12.39**
95.	**LUL should ensure that, by October 1991:**	
	(a) **all major projects, and most other projects use the full Track system;**	**12.42**
	(b) **Track has the processing capacity to handle the anticipated workload; and**	**12.42**
	(c) **managers have ready access to equipment.**	**12.42**
96.	LUL should ensure that it has developed a simplified version of Track for use on smaller projects by October 1991.	12.42

Commercial use of assets

97.	DTp should consider undertaking a thorough evaluation of the extent to which the financial regime within which LUL is obliged to operate may lead to the setting of a less challenging budget figure for the capital proceeds from property disposal and development than would otherwise be the case and may unduly influence the timing of deals and the decision whether to take payment by way of capital receipts or rental income/benefits in kind.	13.57
98.	DTp should consider assessing the extent to which LUL's non-traffic income might with advantage be increased through the implementation of commercial projects with attractive payback periods funded by suppliers or by means of more flexible borrowing provisions within the present EFL arrangements.	13.57
99.	LUL should quickly determine how best to secure improved relations between LUL and LTA, and take action accordingly.	13.58
100.	LUL and LTA should review their advertising pricing policies and costs in the course of the financial year 1991/92.	13.60

Quality of service

101.	LUL should initiate discussions with DTp with a view to establishing revised performance indicators before April 1992. The discussions should give attention to measures of customer satisfaction and service output as well as measures of input.	14.125

102.	LUL should extend the approach followed in adopting the four Business Goals and set itself quantified key goals for achievement each year. These goals should be publicised and performance against them used to demonstrate changes in the quality of service to LUL's customers.	14.125
103.	LUL should propose a suitable measure related to the number of disruptions to service on each line in excess of 15 minutes and to their average duration. In reporting progress against this measure LUL should identify the major causes of service disruptions, the extent to which these are within the control of management and the action that it is taking where possible to reduce them.	14.127
104.	From September 1991 LUL should publish regularly every four weeks the average morning and evening peak, and off-peak, waiting times for each line in the preceding period compared with the scheduled service intervals.	14.128
105.	If an increased peak capacity target is set in future, separate figures should be set for each line related to its level of overcrowding and the technical capacity constraints on the line.	14.129
106.	LUL should put forward proposals for a measure directly related to the peak crowding on each line for consideration in the overall review of targets. This measure could be based on LUL's own internal sampled estimates of the probability of travelling on an overcrowded train in the peak period on each line.	14.130
107.	LUL should continue to develop further more advanced methods of controlling overcrowding, including methods of improving the regularity of services and restricting stop times in stations.	14.131
108.	LUL should make more systematic use of its TSM to simulate the effect of changes in service patterns, with a view to identifying the optimum pattern of service on each line by December 1992. The passengers' views on each line should also be a prime consideration and LUL should have regard to the impact of any service changes on its measures of customer satisfaction with the train service.	14.132
109.	LUL should review whether revised central area service patterns, including the increased use of shuttles between main-line terminals on appropriate lines, should be introduced.	14.132
110.	LUL should continue to investigate measures to improve passenger information such as dot matrix and VDU displays at station entry points, better advance warnings of service problems to NSE passengers and the further upgrading of PA systems at stations and on trains.	14.133
111.	The present DTp target for the internal cleaning of trains should be replaced by an output measure based on sampled train cleanliness, or by a customer satisfaction measure.	14.135
112.	LUL should give priority, as funds permit, to such anti-graffiti measures as improved depot security and the painting of trains, and should bring forward the proposals it has developed for revising the joint pattern of service on the Circle and Hammersmith and City Lines to enable more satisfactory cleaning to take place.	14.137

113.	LUL should continue its joint efforts with BTP to improve passenger security and extend the successful crime prevention initiative taken at the southern end of the Northern Line. It should also take further steps to publicise the reduction in the level of violent crime that it has achieved.	14.138
114.	LUL should consider in detail, jointly with BTP, the implications of any proposed reductions in the number of front-line station staff outside the booking offices, particularly in high-crime areas, and should closely monitor any resulting effects on its passenger satisfaction measures at the stations concerned.	14.138

H H HUNT *(Chairman)*

F E BONNER

L A MILLS

G WHITTINGTON

R YOUNG

S N BURBRIDGE *(Secretary)*

29 April 1991

Glossary

ACAS	Advisory, Conciliation, and Arbitration Service.
AEU	Amalgamated Engineering Union.
ALA	Association of London Authorities.
ARTEMIS	A proprietary project management software package.
ASLEF	Associated Society of Locomotive Engineers and Firemen.
ATC	Automatic train control.
ATO	Automatic train operation.
BR	British Rail.
BS 5750/ISO 9000	British and International Standards for quality assurance.
BTOG	British Transport Officers' Guild.
BTP	British Transport Police.
Business Plan	The **LUL** Budget and Five-Year Business Plan.
Business unit	An identified management unit within **LUL** operating within an agreed budget, either as a cost or profit centre.
Capitalcard	Season ticket which provided unrestricted travel on **NSE**, the Underground and most bus services within Greater London, or within particular zones. This has been replaced by the relaunched **Travelcard**.
CART	Computer Aided Railway Timetable.
CBI	Confederation of British Industry.
CCTV	Closed circuit television.
Central overheads	Costs incurred in maintaining central services and Headquarters staff not otherwise charged to accountable **business units**.
Centurion managers	An additional level of managers introduced by **LUL** after the **Fennell Report** in order to provide identifiable managers responsible for groups of, typically, up to 100 staff.
Champion	A manager designated to lead an improvement initiative or deal with a particular topic within a directorate on behalf of its other managers.
Client	Responsible for establishing the objectives of a project, securing authorisation and delivering against the agreed objectives.
Client agent	Appointed by a client as his/her day-to-day deputy.

Client engineer	Has corporate regulatory responsibility for the designated assets within his/her stewardship.
CLRS	Central London Rail Study.
Conciliation grades	The majority of wages staff other than workshop staff; covered by the main machinery of negotiation, and undertaking principally train crew, signalling and station duties, and track, train and signalling maintenance activities.
Corporate Plan	Five-year plan for **LUL** as a whole (ie railway and ancillary businesses).
Cost office	The accounting unit supporting one or more accountable **business units**.
Cost of operations	Cost of operating, maintaining and administering the company, excluding depreciation and renewals.
Customer satisfaction rating	A composite measure of customer attitudes to service quality.
DESU	Depot Engineering Support Unit.
Direct costs	Costs which can be identified with a product or saleable service, including direct wages, direct materials and direct expenses.
DLOMS	Direct Labour Organisation Management System.
DLR	Docklands Light Railway Ltd.
DTp	Department of Transport.
EETPU	Electrical Electronic Telecommunications and Plumbing Union.
EFL	External Financing Limit.
EIS	Executive Information System.
ELRS	East London Rail Study.
EOW	Equipment Overhaul Works located at Acton. Undertakes the repair and overhaul of rolling stock equipment such as compressors, traction motors, wheelsets and seats, and manufactures escalator drive chain.
ETC	Engineering Training Centre.
Executive Committee	The committee responsible for day-to-day control of **LUL**. It is made up of senior **LUL** management.
FDDI	Fibre distributed data interface.
Fennell Report	*Investigation into the King's Cross Underground Fire*, published on 10 November 1988. The inquiry was chaired by Sir Desmond Fennell QC.

Fettling	Permanent way maintenance work involving the general tightening up of track components.
GER	Great Eastern Railway.
GLC	The former Greater London Council.
GL:M	General Ledger:Millenium. The new corporate accounting package.
Hidden Report	The report into the Clapham Rail Disaster, published on 7 November 1989. The inquiry was chaired by Sir Anthony Hidden QC.
HMT	Her Majesty's Treasury.
IBM	International Business Machines Corporation.
IFR	Investment and Financing Review.
Internal contractor	An internal direct labour organisation responsible for executing work activities specified by the **client** engineers under contractual arrangements.
Intra-company balances	Accounting balances between **business units** within **LUL**.
Investment expenditure	Capital expenditure, renewal expenditure and capitalisation of third party funded assets.
IPCS	Investment Planning Control System.
ISRS	International Safety Rating System. A proprietary system to measure and audit safety performance.
ISWP	Improved Services Working Party.
IT	Information Technology.
ITSG	Information Technology Steering Group.
JCU for CS	Joint Committee of Unions for Cleaning Services.
JNCAS	Joint National Council for Administrative Staff.
JNCEO	Joint National Council for Engineering Operations.
JNCRWSS	Joint Negotiating Committee for Railway Workshop Supervisory Staff.
JNCRWWS	Joint Negotiating Committee for Railway Workshop Wages Staff.
Journey Planner	Schematic map of the Underground system.
JWP	Joint working party.
LAS	London Assessment Studies.
LBL	London Buses Ltd and its predecessors.

LCCI	London Chamber of Commerce and Industry.
LFCDA	London Fire and Civil Defence Authority.
LGM	Line General Manager.
Line businesses	Ten line businesses were created in November 1988, each headed by a General Manager.
LPTB	London Passenger Transport Board.
LRPC	London Regional Passengers' Committee.
LRT Act	London Regional Transport Act 1984.
LRT and LT	London Regional Transport and its predecessors.
LSDM	Learmonth and Burchett System Development Methodology.
LTA	London Transport Advertising.
LTE	London Transport Executive.
LTP	London Transport Property.
LTS	London Transportation Study.
LTS model	A transportation planning model originally developed by the **GLC** and operated on behalf of **DTp** since 1987 by consultants.
LUCC	London Underground Consultative Committee.
LUL	London Underground Ltd and its predecessors.
MDIS	MacDonnell Douglas Information Systems Ltd.
MI	Management information.
MIS	Management information system(s).
MISS	Management Information Systems Strategy.
MSF	Manufacturing Science Finance Union.
MUP	Major Upgrading Programme.
NSE	Network SouthEast.
O-D survey	Origin-destination survey.
Operating expenditure	All costs incurred on the profit and loss account, to maintain the asset value (eg repairs) or to obtain revenue (eg operations, traction current) and including items charged from project expenditure (including depreciation and renewals).
OPO	One-person-operated train-a conventional or automatically driven train, normally manned by one train operator.
Overheads	The total cost of indirect materials, wages and expenses.

PA	Public address.
PC	Personal computer.
PER	Project Expenditure Requisition.
Permanent way	The track on which trains operate and its immediate environs.
PICK	A computer operating system.
`PLEASE'	Acronym for corporate mission statement: - to be a key **P**artner in London's life and its continued prosperity; - to become once again a **L**eader in the world's underground networks; - to provide customers with an **E**njoyable travel experience, and a similar work experience for employees; - to provide good services **A**ffordable to Londoners and visitors; - to ensure that services are **S**afe for customers and staff; and - to be regarded by customers and shareholders as **E**fficient and to be satisfied that London Underground actually is.
PMS	Property Management System.
POM	Passenger operated ticket-issuing machine.
Possession time	The time available to engineering staff for work on the track and adjacent equipment and structures-no more than four hours a night on the tube parts of the LUL system.
Programme lift	Planned overhaul of trucks (bogies) including replacement of wheels and traction motors. The planned interval between such lifts ranges from 1½ years to 4½ years depending on the line and rolling stock type.
Project expenditure	This includes capital expenditure, renewals, project operating expenditure, project work on **LUL** assets funded by third parties and project work undertaken for third parties on their assets at their expense (sundry debtor work).
Project Manager	Responsible for the project implementation process, delivering to time and cost against the objectives agreed with the **client**.
PSD	Passenger Services Directorate.
PSE	Premises and Structures Engineer.
PSG	Professional Services Group.
PT&R	Promotion, Transfer and Redundancy.
Railway	Premises and land in use for railway and ancillary purposes including station approach roads and forecourts where these are owned or occupied by **LRT** or its subsidiaries.
REG	Resource Evaluation Group.
REMS	Railway Engineering Management Systems.

Ring fencing	The earmarking of funds provided by the Government to finance new investment in nationalised industries for the benefit of specific (and normally very substantial) investment projects and the segregation of such funds from the Government's normal capital grant to those industries.
RMT	National Union of Rail, Maritime and Transport Workers (formerly National Union of Railwaymen).
RNC	Railway Negotiating Committee.
RPIS	Railway Personnel Information System.
RSE	Rolling Stock Engineer.
RTC	Railway Training Centre.
Secretary of State	The Secretary of State for Transport.
Section 12	Of the Fire Precautions (Sub-surface Railway Stations) Regulations 1989.
SMI	Station Manager's Instructions.
SSADM	Structured Systems Analysis and Design Methodology.
Station staff	All grades of **PSD** allocated to duties on a station.
Station supervisor	A member of the **PSD** in charge of a station.
SUTOR	Superbrain Timesheet Operating Railways-a timesheet analysis system.
SVT	Stored Value Ticketing-a pre-purchased ticket, the value of which decrements with use.
Tamping	Compacting the ballast beneath the sleepers on the open sections of track, undertaken by rail-mounted machines.
TAR	Time Attendance Recording.
TGWU	Transport and General Workers' Union.
TIMS	Technical Information Management Systems.
TMU	Train Modification Unit.
TOMAS	Train Overhaul and Maintenance System.
TPH	Trains per hour.
TRAC	Tube Research Audience Classification.
Track	LUL's project management computer system, based on **ARTEMIS**.
Travelcard	Season ticket which provides unrestricted travel on **NSE**, the Underground and most bus services within particular zones. This was relaunched to replace **Capitalcard**.

TSM	Train Service Model.
TSSA	Transport Salaried Staffs' Association.
UCATT	Union of Construction and Allied Trades Technicians.
UIP	Underground Investment Programme.
UNIX	A computer operating system.
UTS	Underground Ticketing System.
Zone of innovation	A part of the **LUL** network in which an experiment is undertaken to improve the quality of service in an innovative way.

APPENDIX 1.1
(referred to in paragraph 1.1)

The reference and background

1. On 30 October 1990 the Department of Trade and Industry (DTI) sent to the MMC the following reference:

> The Secretary of State, in exercise of his powers under Section 11(1)*(a)* and *(b)* of the Competition Act 1980, hereby refers to the Monopolies and Mergers Commission (`the Commission') the questions set out below relating to the efficiency and costs of and the service provided by London Underground Limited (`LUL') in supplying passenger and other services.
>
> The Commission shall upon this reference investigate and report on the following questions:
>
> 1. Whether in supplying the said services LUL could improve its efficiency and thereby, without affecting targeted improvements in levels of safety or in the quality of the service provided, reduce its costs; whether the quality of the service provided could be improved without any increase in costs; and the extent to which a higher quality of service might generate higher net revenue; with special reference to:
>
>   *(a)* the scope for improvements in efficiency and manpower productivity and the appropriateness of the management structure;
>
>   *(b)* the method of determining the level and structure of fares and the relationship of fares both to cost structures and to the level of peak and off-peak demand on the network;
>
>   *(c)* the management of LUL's investment programme and the appraisal and management of individual capital projects;
>
>   *(d)* the efficiency of LUL in adjusting services to match demand and whether greater efficiency would increase net revenue;
>
>   *(e)* the extent to which any deficiency in the quality of service is the result of inefficiency and in particular whether there is scope for improving the quality of LUL's service by making more effective and efficient use of existing resources;
>
>   *(f)* the scope for improving operational capacity, reducing overheads and, with due attention to safety, securing reductions in operating, maintenance, repair and renewal costs particularly by improving working practices, optimum timing of work and contracting out appropriate work;
>
>   *(g)* the quality and effectiveness of LUL's systems of allocating costs to its business units and divisions and for monitoring and controlling these costs; and
>
>   *(h)* whether LUL makes full commercial use of assets, including the use and redevelopment of properties in its operational use, and in the provision of ancillary services and concessions.
>
> 2. Whether in relation to any matter falling within the questions set out above LUL is pursuing a course of conduct which operates against the public interest.
>
> The Commission shall report on this reference within a period of six months.
>
> *(signed)* G C RIGGS
> *An Assistant Secretary*
> *Department of Trade and Industry*

30 October 1990

2. The composition of the group of members of the MMC which was responsible for this inquiry and report is indicated in the list of members in the preface.

3. DTI issued a press notice on 30 October 1990 announcing the terms of the reference and inviting persons wishing to do so to give evidence to the MMC. Notices advertising the reference and inviting interested parties to submit evidence to the MMC were placed in the *Financial Times*, *Modern Railways* and the *Evening Standard*.

4. LUL provided much written material at our request and attended hearings on 25 and 26 February, and on 27 March 1991 when LUL's non-executive directors also attended a separate hearing, accompanied by the non-executive directors from LRT. During the inquiry we visited a number of LUL stations and operational facilities, including EOW at Acton and other depots, and officials made extensive fieldwork visits.

5. We received written evidence from DTp, BR, LRPC and other rail user groups, LFCDA, trade unions, the CBI, ALA and several local authorities in London, tourist boards, other transport bodies and individual members of the public. Appendix 1.2 lists all those who provided such evidence and indicates those who attended hearings. The representations we received from third parties are drawn on throughout our report.

6. In consultation with LUL we selected its Central and Metropolitan Line businesses as the subject of more detailed case studies, with a view to highlighting the varying levels of services and quality experienced by passengers throughout the LUL network and explaining the reasons for these variations. Our findings from these studies are reported in Appendix 2.1, and we draw on them in the main body of our report.

7. Reviews were carried out on behalf of the MMC by PA Consulting Group, in relation to both the maintenance of rolling stock (see Chapter 8) and project management (see Chapter 12); by Mr T Powell in relation to the level and structure of fares (see Chapter 10); by Mr D Silcock in relation to demand measurement, forecasting and modelling (see Appendix 9.1); and by Drivers Jonas in relation to LUL's commercial use of assets (see Chapter 13).

8. Some of the evidence we received during our inquiry was of a confidential nature and our report contains only such information as we consider necessary for an understanding of our conclusions.

9. We would like to take this opportunity to thank those who assisted us in our inquiry. We are particularly grateful to those at all levels within LUL on whom the main burden of our inquiry fell.

APPENDIX 2.1
(referred to in paragraphs 2.2, 2.3, 2.5, 3.41, 4.54 and 14.61 and Appendix 14.1, paragraph 1)

Case studies of two line businesses

Background

The case studies

1. In consultation with LUL we selected two of its ten line businesses as the subject, within the constraint of available resources, of specific case studies (see paragraph 6 of Appendix 1.1). The two businesses were the Central and Metropolitan Lines. The Central Line, which is the longest on the Underground, has been subject to a high level of passenger complaints and is due to benefit from substantial renewals investment by 1995 (see Chapter 11). It is also for much of its length a deep-tube line. By contrast the Metropolitan Line, a descendant of the world's first Underground (steam) railway, actually runs under ground for only 6 of its 41 route miles. Three key LUL stations fall under Metropolitan Line management and one under Central Line management. Of the former stations, King's Cross and Liverpool Street are LUL's second and fourth busiest stations[1] while Central London's Baker Street station has the highest number of platforms and serves three lines in addition to the Metropolitan. Oxford Circus station, under Central Line management, is LUL's third busiest station and serviced by the greatest number of escalators.

2. We invited evidence from those railway user groups actively interested in the performance of the Central and Metropolitan Lines and this is summarised in the following studies, along with the relevant comments received from other interested parties. LUL's performance against the four Business Goals which it set itself in June 1990 (see paragraph 14.8) is also highlighted in the studies.

Central Line

Historical background

3. The Central Line is an east to west line running from Ongar to West Ruislip and Ealing Broadway. A schematic map is provided at Figure 1. The first section was opened in 1900 between Bank and Shepherd's Bush using small bore tunnels and a third rail electric system. Extensions followed to White City in 1908, Liverpool Street in 1912 and Ealing Broadway in 1920. Between 1938 and 1940 the tunnels were enlarged and the line converted to the fourth rail electric system. However, clearances in the vicinity of the track remained very limited and the design and arrangement of equipment on the rolling stock reflect this.

4. After the Second World War the line was extended in stages, using both the former Great Western Railway route to reach West Ruislip in 1948 and, in part, former Great Eastern Railway (GER) routes to reach Leytonstone and form a loop line via Newbury Park, Hainault and Woodford back to Leytonstone, with an extension to Loughton, also in 1948. In 1949, once again using former GER route, the line was extended to Epping and in 1957 the shuttle service between Epping and Ongar was transferred from BR.

The route

5. The present day Central Line operates along a route of 52 miles and serves a total of 51 stations. Between White City and Leyton the line is in deep-level single-bore tube tunnels, apart from surfacing briefly at Stratford station and a cutting at Mile End station. The line in the west is in the open beyond White City, but in the east there is a further tube tunnel section between Leytonstone and Newbury Park; otherwise the line is in the open.

[1]Defined in terms of the numberof passenger journeys per year starting and/or ending at those stations

FIGURE 1

Notes:

1. Roding Valley: now open at weekends and subject to the same service restrictions as Chigwell and Grange Hill.
2. Epping—Ongar: Monday—Friday: peak hours only.

Source: LUL.

6. The Central Line does not have any shared sections of route although it does share Ealing Broadway station with the District Line. It has another interchange with the District Line at Notting Hill Gate and with the Circle Line at this station plus Liverpool Street, which also has an interchange with the Hammersmith and City and the Metropolitan Lines. Between these two stations the Central Line has interchanges with the Jubilee Line at Bond Street, the Bakerloo and Victoria Lines at Oxford Circus, the Northern Line at Tottenham Court Road and Bank and the Piccadilly Line at Holborn. At Bank station it is also possible to interchange with the District Line via an underground passageway and with the BR-operated Waterloo and City Line. There is a fourth interchange with the District Line and a second with the Hammersmith and City Line at Mile End.

7. Liverpool Street is the only central BR terminus served by the Central Line although there are also interchanges with BR services at Stratford, Ealing Broadway, Greenford, South Ruislip and West Ruislip. In addition Stratford provides an interchange with DLR.

Competition from other transport operators

8. The Central Line's main competition comes from BR at both the eastern and western ends of the line. To the west BR runs commuter services from High Wycombe into Paddington and Marylebone, via South and West Ruislip, and from Greenford to Paddington via Ealing Broadway and Westbourne Park. To the east NSE services run via Stratford into Liverpool Street. More significant competition is envisaged with the introduction of the BR/LRT Crossrail service scheduled for 1999: the Central Line is forecast to lose some 13 to 14 per cent of passenger demand. LUL told us that there are no significant bus competitors for the main parts of the Central Line service. However, bus routes offer competition primarily in the suburbs and during the off-peak, particularly for non-radial journeys.

Rolling stock

9. Most Central Line rolling stock dates back to 1962 and is made up into 167 four-car units comprising a driving motor car at each end with one non-driving motor car and one trailer car in between. However, the Epping to Ongar shuttle service is operated by 1960 tube stock formed in three three-car units comprising two driving motor cars and one trailer car. The 1960 stock was used to test the ATC system intended for the Victoria Line; however, because of increasing unreliability and maintenance difficulties the automatic working was abolished in the mid-1980s. The three units still in service have been converted to OPO and are not compatible with the 1962 tube stock, which continues to operate with both driver and guard. In the morning and evening peak the Central Line schedules 70 eight-car trains for the main-line service and one three-car train for the Epping to Ongar shuttle. The number of eight-car trains in off-peak periods ranges between 30 and 43 and no three-car shuttle runs in the off-peak periods.

10. A programme of safety modification work on the 1962 tube stock was begun in mid-1989 and generally completed within 12 months. The work included:

(a) the conversion of passenger emergency valves to passenger alarm only operation;

(b) the fitting of high-intensity headlights;

(c) the provision of PA facilities; and

(d) the replacement of all plastic ceiling panels.

As part of the Central Line modernisation programme (see Chapter 11) the 1962 stock is scheduled to be replaced by 1992 tube stock, the first train of which is planned to be delivered in the autumn of 1991 and to enter passenger service in the early summer of 1992. The 1962 stock will then either be scrapped or transferred to the Northern Line, the only other line which has yet to be converted to OPO.

Quality of service

Timetable

11. Table 1 shows examples of the weekday train service intervals on the Central Line.

TABLE 1 **Examples of Central Line weekday train service intervals, April 1991**

Minutes

	Morning peak	*Afternoon off-peak*	*Evening peak*	*Evening off-peak*
Eastbound				
Ruislip to North Acton	3½-12½	10	3-10	15
North Acton to White City	2-5	3½-6½	2-4	5-10
White City to Liverpool Street	2½-3	3-3½	2	5
Westbound				
Epping to Debden	7-9	20	6-11½	15
Debden to Loughton	3½-7	20	6-11½	15
Loughton to Woodford	3½-7	10	3-10½	15
Woodford to Leytonstone	2½-4½	10	2½-6½	15
Leytonstone to Liverpool Street	2	5	2½	5
Liverpool Street to White City	2	3-3½	2½	5

Source: LUL.

12. Timetabled journey times from Epping to West Ruislip at the extremities of the main section of the Central Line vary from 88½ minutes before the morning peak to 92 minutes at the height of the morning peak. The effect of peak congestion is thus to add 3½ minutes to the scheduled journey time.

Performance indicators

13. A range of performance targets is set annually for each LGM covering:

- service, customer and staff safety;
- service quality;
- service quantity;
- financial contribution;
- staff performance;
- asset performance; and
- business planning.

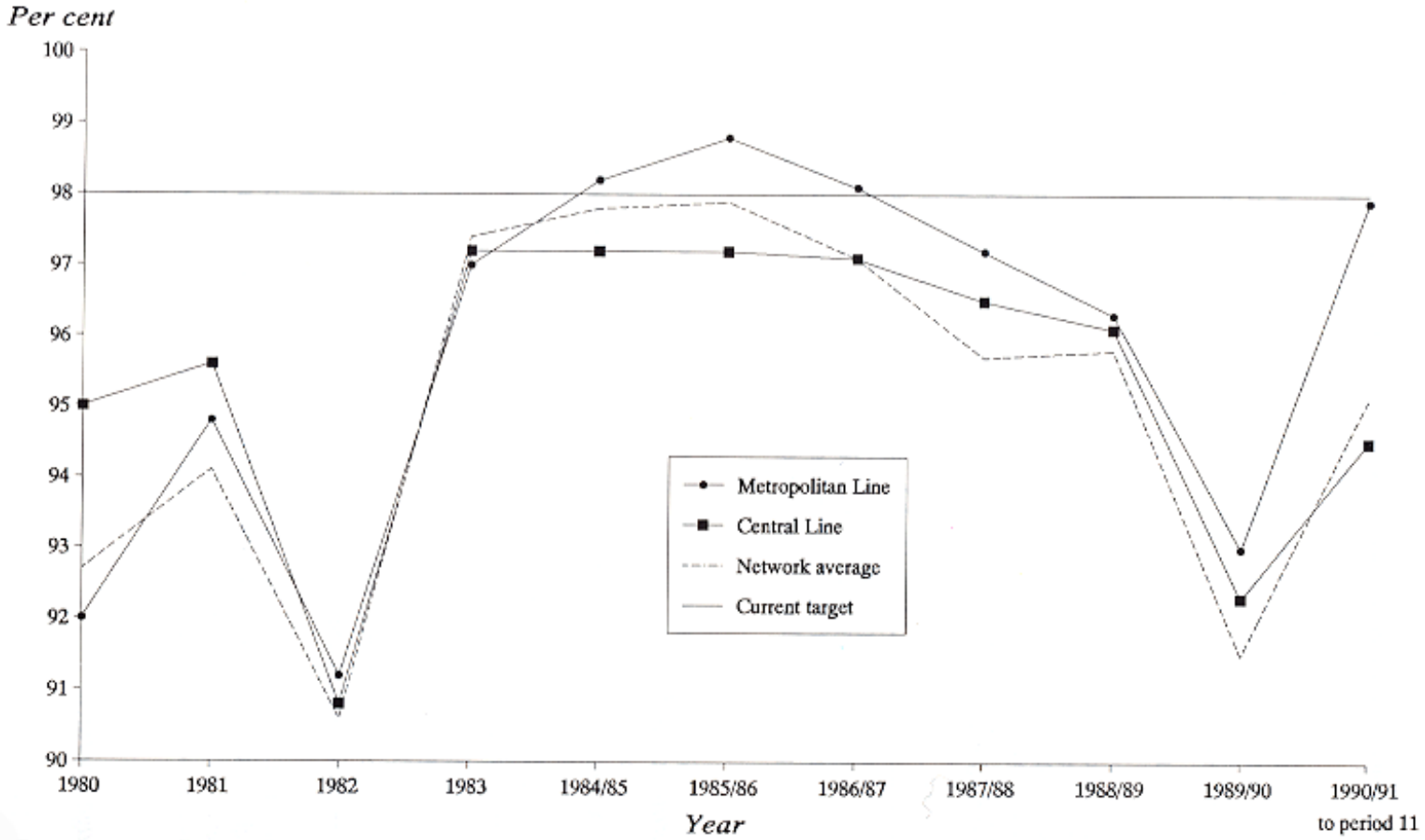
A number of different indicators are used to measure operating performance on a four-weekly basis throughout the year. Where appropriate the performance indicators and targets are disaggregated to line level, as are the customer satisfaction indicators (see paragraphs 14.5 and 14.7). The LGMs' targets are increasingly orientated towards these customer satisfaction measures.

Mileage operated

14. Until 1986/87 the only quality of service indicator reported regularly at line level was the mileage operated as a percentage of the scheduled mileage (see paragraph 14.16). Figure 2 shows the performance of each of our two case study lines since 1980 compared with the network average mileage operated. The long-term performance of the Central Line closely follows the average performance of the Underground for this measure.

FIGURE 2

Mileage operated, 1980 to 1990/91 as a percentage of schedule



Source: LUL.

15. To allow for potential disruption caused by the Central Line Project, the Central Line has been set a minimum target of operating 95 per cent of its scheduled miles in both the peak and off-peak, rather than the 98 per cent minimum to be achieved in 1992 set for all other lines. Table 2 shows recent performance against this target.

TABLE 2 **Proportion of scheduled mileage operated: Central Line**

per cent

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*April 1992 target*
Peak				
Central Line	92.0	89.7	90.4	95
All lines	92.1	90.1	92.3	98
Off-peak				
Central Line	97.0	95.0	96.7	95
All lines	97.2	96.0	96.9	98
Total				
Central Line	95.2	93.1	94.5	95
All lines	95.5	94.0	95.4	98

Source: LUL.

In off-peak periods the Central Line's performance is close to the network average. In peak periods, however, performance is well short of the 95 per cent target and below the network average, which is itself depressed by the poor performance of the Victoria Line (see paragraph 14.19).

Reliability

16. The development of basic MIS enabled LUL to add reports of excess waiting times analysed by line from 1986/87 (see paragraph 14.30). Figure 3 shows the performance of each of our two case study lines since 1986/87 compared with the network average excess waiting times. In the case of the Central Line the data are based on sampled observations of waiting times at Woodford, Wanstead, Leytonstone, Bethnal Green, Bank, Oxford Circus, Notting Hill Gate, North Acton and Hanger Lane. There has been a significant increase in the excess waiting times on the Central Line since 1988/89. This is attributed to increasingly prolonged stop times at Liverpool Street and Bank stations caused by severe congestion problems and to recurrent fire safety checks following more stringent procedures introduced in 1988.

17. Table 3 shows the recent reliability performance of the Central Line and demonstrates that this is worse than that of the system as a whole when judged against the DTp target.

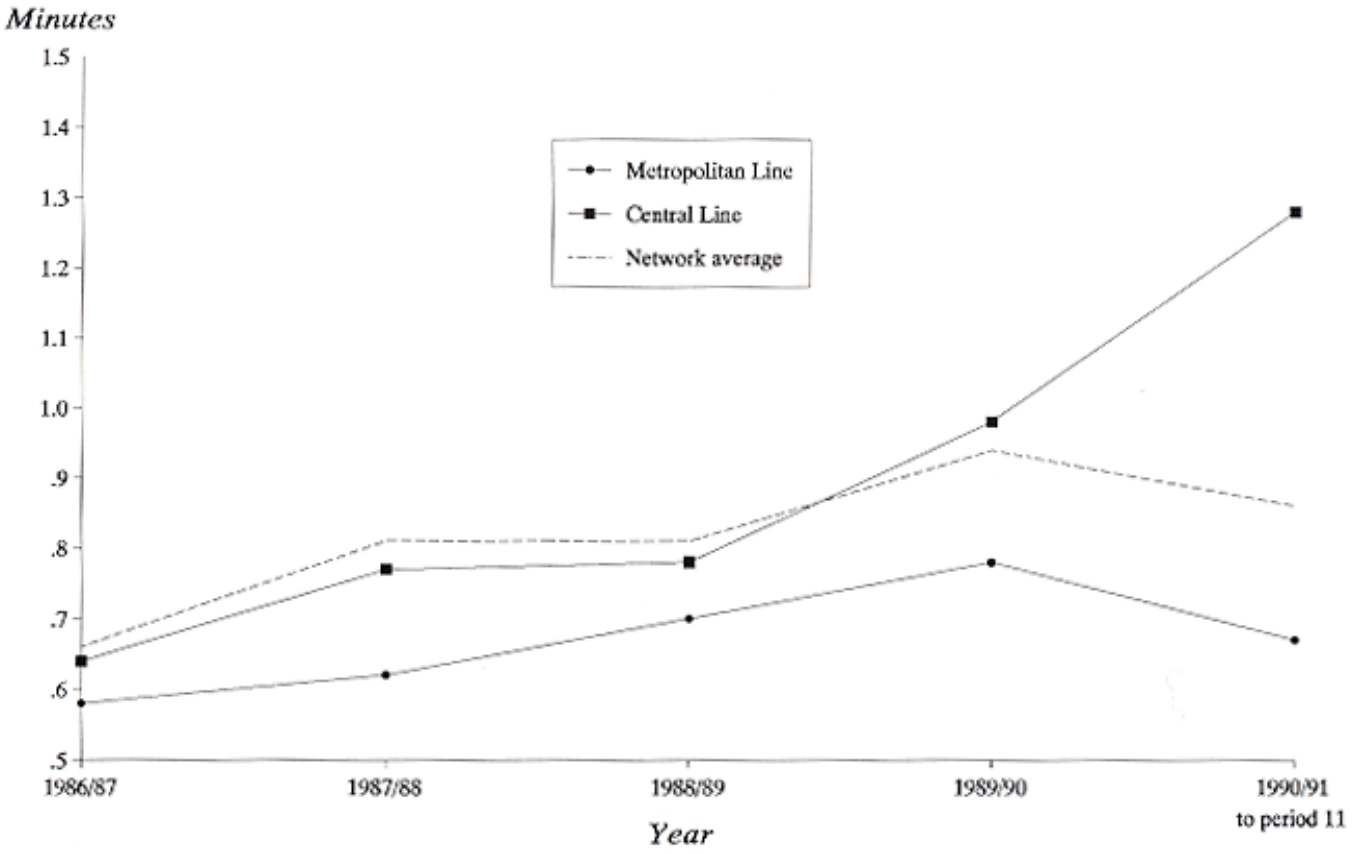
TABLE 3 **Reliability: Central Line**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target*
% chance of waiting more than 1.5 times the scheduled interval between trains:				
Central Line	11.0	13.4	12.1	7
All lines	8.6	10.1	9.5	7
Average wait (minutes)				
Central Line:				
Scheduled	2.7	2.7	2.7	-
Excess	1.2	1.5	1.2	-
Actual	3.9	4.2	3.9	-
All lines:				
Scheduled	2.5	2.5	2.5	-
Excess	0.8	1.0	0.9	-
Actual	3.3	3.5	3.4	-

Source: LUL.

FIGURE 3

Excess waiting time, 1986/87 to 1990/91



Source: LUL.

Peak capacity and peak crowding

18. DTp set LUL an overall target of increasing peak services by 5 per cent compared with 1988 service levels. This was to be achieved by April 1992. Table 4 shows the performance of the Central Line compared with this target. The decline in Central Line peak services is a further illustration of the operating problems experienced on this line.

TABLE 4 **Percentage change in peak trains operated: Central Line (compared with same quarter in 1988/89)**

per cent

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target*
Central Line	-2.7	-0.3	-2.4	-
All lines	+2.0	+6.1	+7.3	+5

Source: LUL.

19. The probability of travelling in an overcrowded train at peak times is also greater on the Central Line than on the system as a whole, as shown in Figure 4 and Table 5.

TABLE 5 **Probability of travelling in an overcrowded train at peak times**

per cent

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Central Line	35	30	32
All lines	27	24	27

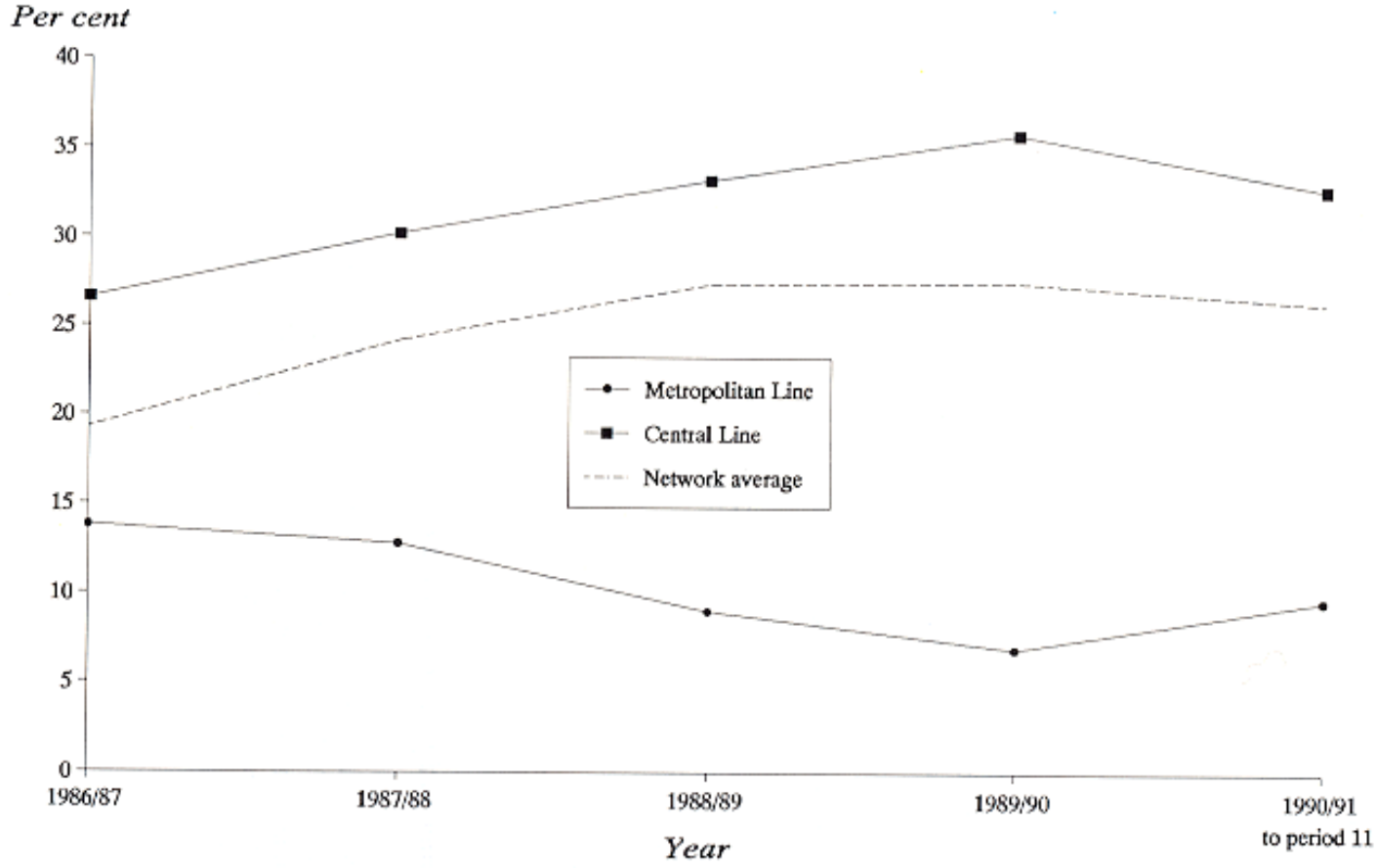
Source: LUL.

Customer satisfaction with train service

20. Regular customer satisfaction surveys enable LUL to examine its performance on detailed parts of the system. Table 6 shows the recent customer satisfaction ratings (see footnote to paragraph 14.31) for customers leaving stations on the three sections of the Central Line compared with the rest of the system. The centre section of the line is defined as that part including the stations from Oxford Circus to Leytonstone.

FIGURE 4

Percentage chance of peak crowding, four quarter averages, 1986/87 to 1990/91



Source: LUL.

TABLE 6 **Customer satisfaction ratings: Central Line (out of 100)**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Service frequency			
Central Line			
West	37	31	51
Centre	36	41	40
East	47	37	26
Whole line	39	37	38
All lines	35	39	42
Crowding in trains			
Central Line			
West	20	20	21
Centre	8	14	9
East	21	20	16
Whole line	14	18	13
All lines	19	18	21

Source: LUL.

21. The service frequency satisfaction rating is a more sensitive indicator than the service regularity satisfaction rating and appears to measure overall satisfaction with the reliability and frequency of the train service. It is apparent from Table 6 that customers using the east section of the Central Line have become markedly less satisfied with their train service during the course of 1990/91. This contrasts with the views of passengers using the west section. LUL told us that the majority of fire and smoke incidents and infrastructure failures had occurred between Liverpool Street and Leytonstone and this had caused more severe disruption at the east end of the line. Passengers on the Central Line are significantly less satisfied with the level of crowding on their trains than those on other parts of the system. This particularly applies to its centre section, which contains the most congested part of the Underground.

Overall quality of train service

22. The main constraints on achieving significant improvements to the Central Line train service are the obsolescent signalling system and the extended station stop times caused by overcrowding. It is therefore unlikely that LUL can achieve major improvements until the Central Line Project is complete. The completion of the Crossrail project will permit a further improvement by diverting some of the passengers and reducing the problems caused by overcrowding.

23. The other significant constraint on performance is the traditional attitude to work within LUL, a key management issue which is being addressed through the Total Quality programme, which has already enabled the Central Line to reduce peak train cancellations.

Station cleaning

24. The 1990/91 budget for station cleaning on the Central Line was £2.7 million. The bulk of the work was contracted out. During 1990/91 the contractors were controlled through a centralised function covering all line businesses. From April 1991, direct control of the contractors passed to the line businesses. This has resulted in a 15 per cent reduction in costs while the same level of cleaning quality has been maintained. There are eight cleaning contracts, placed with five different contractors. Five of the contracts are concerned with basic station cleaning, one with refuse collection, vents and platform inverts and two with graffiti removal. LUL considers that station cleaning on Central Line stations has been considerably improved over the last three years, a view supported by recent trends in passenger satisfaction surveys.

Passenger information

25. Major efforts have been made in the last two years to train front-line staff to present information about the state of the service to customers. These have been assisted by the installation for safety reasons of new PA equipment at stations below ground level and on Central Line trains. Many old unsatisfactory PA systems remain in use, however, and information at station entry points is mainly provided on static whiteboards. Dot matrix train indicators installed on the platforms between Mile End and Marble Arch are popular with customers when they are working correctly, but cause many complaints when they show incorrect, or no, information. Such breakdowns are caused by defective switchgear in the signal cabins from which the dot matrix indicators are currently set manually. As part of the Central Line Project, the new ATC signalling equipment will drive new train indicator equipment, which should be considerably more reliable and flexible. In addition the new train fleet will include digitised speech equipment and improved PA equipment to enable train operators and Line Controllers to provide customer information.

Business Goals

26. The Business Goal 1 target for the Central Line was achieved for three consecutive weeks in January/February 1991 as a result of a steady reduction in the number of cancelled trains. However, the severe weather in February 1991 resulted in damage to the traction motors on a number of trains due to snow intake. Consequently the number of cancellations increased until this problem was overcome. By early April 1991 the target was again being achieved. Achievement of Business Goal 2 is not a line business responsibility (see Chapter 8). However, on the Central Line in early April 1991, 94 per cent of lifts were available and 87 per cent of escalators, compared with 71 per cent and 68 per cent respectively two years earlier. For Business Goal 3 performance measures are in the process of being agreed with the General Manager Quality. As an interim measure line management are monitoring performance using the customer satisfaction surveys. In relation to Business Goal 4 the line business, at present, has very little direct influence but is developing an approach with Engineering which ensures that the asset planning work contained in the 1990/91 line business plan is refined and used from 1991/92 onwards.

Evidence from third parties

27. Two user groups and four members of the public complained about the Central Line train service. The first user group wrote that the timetabled service was satisfactory when it worked but was so unreliable that many travellers preferred to use cars; in particular the Perivale section was sometimes left without a service for up to an hour because trains were turned round at White City or diverted to Ealing. A member of the public complained that the first train in the morning, at 5.15 am, should be earlier, and that evening trains quite often terminated at Loughton, leaving passengers to wait 20 to 40 minutes for a train to Debden.

28. The second user group considered that the Central Line, and the rest of LUL, was unable to function efficiently because of restrictive practices operated by RMT. For instance, whenever services were disrupted, key crew-change stations like Leytonstone and White City were full of train crews who would only take out their originally rostered trains; if the correct crew was not available the service came to a halt. Management had acquiesced in these arrangements but were waiting for the right moment to act. At times of disruption LUL should scrap the normal timetable and run an emergency one; this required management initiative and union co-operation but could certainly be done within existing resources.

29. Generally, those who wrote to us complained that the Central Line was very slow to recover after an incident, or that the train service had deteriorated drastically over the last year-in particular, the fire brigade was called to every single incident and the whole network was brought to a standstill. Two members of the public wanted better information at times of service disruption. The first user group complained that announcements affecting the whole line, made from Baker Street control centre, were often confusing: the most important information for remote stations was when the next train was leaving the nearest station.

30. Members of the public also complained of poor management, apparently uninterested staff and failure to collect tickets. In addition, at Gants Hill there were sometimes four ticket inspectors at a barrier where only two people at a time could pass through; and when the automatic ticket machines were not giving change this meant queuing, often behind people buying season tickets: it was suggested that there should be separate queues for quick purchases. At Holborn the four escalators were often operated three in one direction and one in the other, rather than two each way.

Investment

31. The current problems with rolling stock, signalling and power supply equipment on the Central Line are to be addressed over the next five years, in large part, by the Central Line Project (see paragraphs 11.59 and 11.60). The new rolling stock, due to be introduced between autumn 1991 and the end of 1995, will incorporate many new features, including wider doorways, enhanced PA and emergency passenger communications link, improved ride and Control and Monitoring System to aid fault-finding and improve maintenance. ATC signalling will facilitate a 16 per cent line capacity increase through reduced headways; and improvements to the traction power supply will provide a more even and efficient supply. However, the necessary finances to address the problems of underinvestment in the permanent way, train maintenance depots and station facilities are not yet available.

32. Authority for a feasibility study for capacity enhancements at Oxford Circus station was given by LUL's Finance Committee in September 1990, but work has yet to begin owing to LUL's present financial position. The station's PA system was recently modernised and automated dot matrix indicators installed on the Central (and Bakerloo) Line platforms.

Supply and demand

33. In 1981, 121.4 million passengers travelled on the Central Line, representing 539 million passenger miles, an average of 4.4 miles per passenger. By 1988 passenger numbers had increased by 41 per cent to 170.8 million, compared with an increase of 50 per cent for the Underground overall. The lower increase for the Central Line reflects the already heavy loading on the line from the east in 1981. Passenger journeys declined somewhat to 164.0 million in 1990.

34. The demand for Central Line services varies by section of route and time of day. Table 7 shows the density of demand at different times of day on different sections of route as estimated in 1987 (the last year for which detailed figures are available), and the frequency of train service provided, in the summer of 1990.

TABLE 7 **Central Line: comparison of supply and demand by section of route, 1987 estimates***

Passengers per hour

	Passengers per day	*Peak (7 am-10 am and 4 pm-7 pm)*	*Between peak (10 am-4 pm)*	*Evening (7 pm-10 pm)*
Section: West Ruislip-North Acton				
Least used: West Ruislip-Ruislip Gardens	2,571	274	123	62
Most used: Hanger Lane-North Acton	24,880	2,852	990	610
Frequency of service (minutes)		5-12	10	15
Section: Ealing Broadway-North Acton				
Least used: Ealing Broadway-West Acton	29,403	2,267	840	588
Most used: West Acton-North Acton	22,609	2,528	931	619
Frequency of service (minutes)		4-8	10	15
Section: North Acton-White City				
Least used: North Acton-East Acton	49,643	5,528	1,959	1,357
Most used: East Acton-White City	52,440	5,822	2,158	1,522
Frequency of service (minutes)		2-5	3-6	5-10
Section: White City-Leytonstone				
Least used: White City-Shepherd's Bush	57,726	6,307	2,427	1,776
Most used: Holborn-Chancery Lane	210,814	21,057	11,487	5,182
Frequency of service (minutes)		2-3	2-5	5
Section: Leytonstone-Hainault				
Least used: Fairlop-Hainault	5,920	693	192	203
Most used: Leytonstone-Wanstead	38,736	4,695	1,319	885
Frequency of service (minutes)		4	10	15
Section: Leytonstone-Loughton				
Least used: Buckhurst Hill-Loughton	13,240	1,568	445	392
Most used: Leytonstone-Snaresbrook	41,696	5,048	1,342	1,118
Frequency of service (minutes)		4	10	15
Section: Loughton-Epping				
Least used: Theydon Bois-Epping	4,166	443	152	132
Most used: Loughton-Debden	7,659	882	270	249
Frequency of service (minutes)		8†	20	15

Source: MMC based on LUL data.

*The peak figures are averages and understate the level of demand during the busiest peak hour.
†4.8 minutes Loughton-Debden.

35. On weekdays the service is provided between the following hours:

	First train leaves	*Last train arrives*
Epping	05.08	00.55
Hainault	05.25	00.57
Ealing Broadway	05.34	00.43
West Ruislip	05.29	00.59

The first trains pass through Oxford Circus at 05.38 (eastbound) and 05.57 (westbound). The last trains pass through Oxford Circus at 00.15 (eastbound) and 00.32 (westbound).

36. In addition to the main-line services, shuttle services from Woodford to Hainault and Epping to Ongar are operated. The Woodford-Hainault service operates between 06.03 (Hainault departure) and 19.59 (Woodford departure) with a 40-minute service frequency throughout the day but supplemented by additional trains between Grange Hill and Woodford during the peak periods, in the peak direction only. In 1987 a total of 2,473 passenger journeys per day were recorded over the most heavily-used section of this line. The Epping-Ongar service operates in the morning between 06.37 (Epping departure) and 08.07 (Ongar departure) and 08.38 (North Weald departure). The first evening train departs from Epping at 16.27 and the last train leaves Ongar at 18.57. A 33- to 43-minute interval service is provided. In 1987 a total of 194 passenger journeys per day was recorded over the most heavily-used section of this line.

37. The Central Line's present scheduled service calls for a maximum of 30 TPH in the peak, though actual performance tends to be around 27 or 28 TPH. A schedule of at least 33 TPH is planned as being regularly achievable following implementation of the Central Line Project. In addition an analysis is being undertaken of a number of proposed schemes for emergency crossovers to improve the service during times of disruption. Track quality improvements and the easement of speed restrictions are also in the early study stage.

38. The 1995 exit/entry forecast projects a number of changes in future demand. Chief amongst these are a shift in station entries from Liverpool Street to Stratford and a significant increase in entries at Bond Street station after the opening of the Jubilee Line extension; a sharp increase in exits at Bank station after the opening of the DLR; and considerably increased traffic at Lancaster Gate upon the opening of the Heathrow-Paddington link. The same factors are expected to apply in 2001 as in 1995, with the addition of a significant development at North Acton station. The introduction of the Liverpool Street to Paddington Crossrail, running parallel to the Central Line, is forecast to result in a reduction in demand. For example, LUL forecasts a reduction of 119,500 passenger miles in the three-hour morning peak on the Central Line, ie a fall of some 14 per cent. Figure 5 and Figure 9.5 (see Chapter 9) show the projected level of overcrowding in 2001 with and without Crossrail. Crossrail is projected to eliminate severe overcrowding on the Central Line but crowding will still exceed LUL's planning standard on some sections of the line.

39. At present there is no direct marketing of Central Line services, but off-peak services will be promoted as the renewal of rolling stock and introduction of ATC begin to improve the quality of service. Consideration is being given to turning the lightly-used, loss-making Epping-Ongar section of the line, which is in need of significant infrastructure investment, into a leisure attraction, by securing private capital.

Financial results

40. As from the beginning of 1989/90 LUL adopted a line contribution approach to its financial reporting. The principal features of this approach are that:

(a) identifiable and controllable costs;

(b) cash takings from sale of tickets, adjusted to an accruals basis;

(c) other traffic income distributed on an algorithmic basis; and

(d) apportioned costs

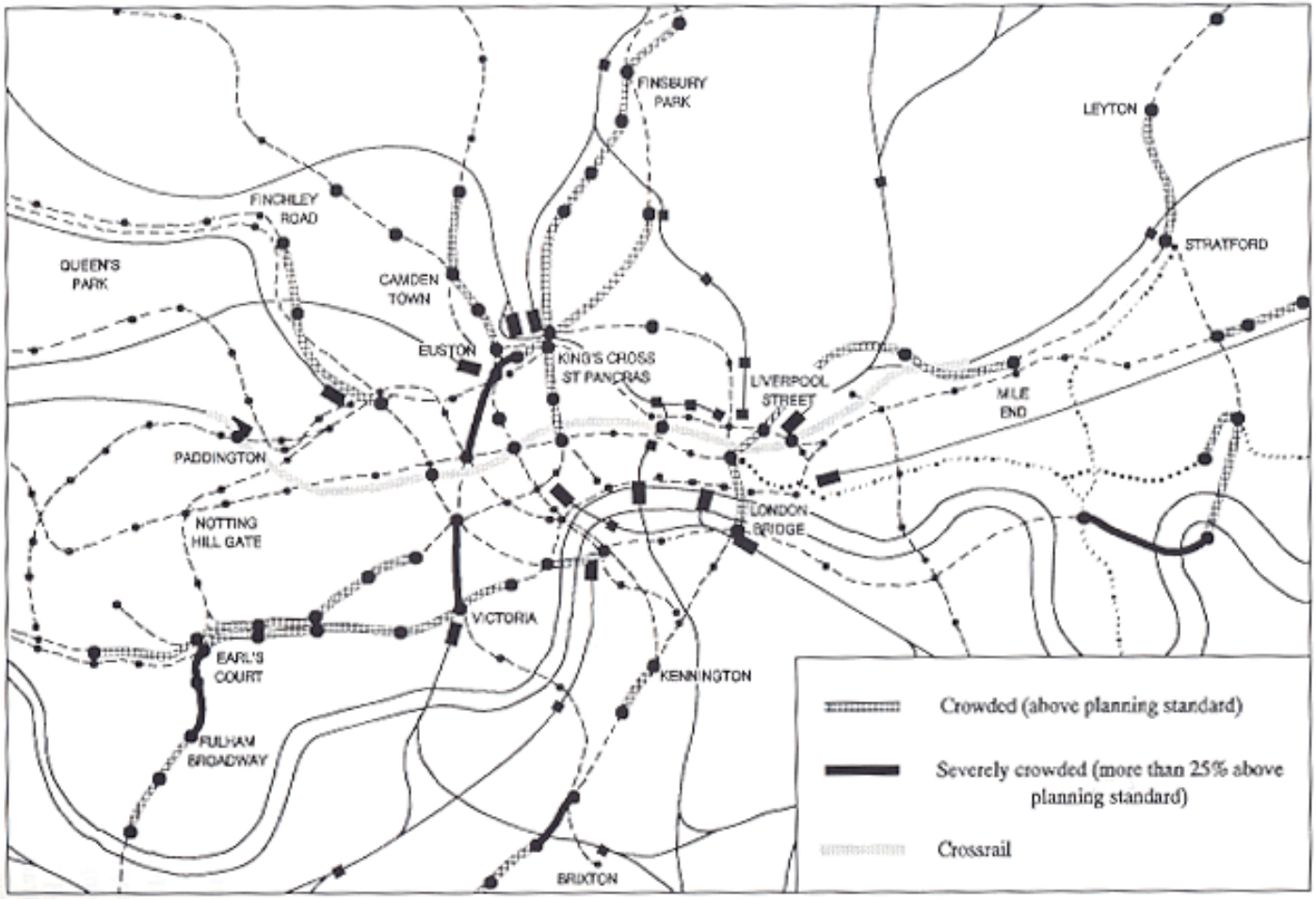
are identified with the individual line businesses.

41. Following the introduction of a new General Ledger and Chart of Accounts in January 1990, the range of both directly attributed and apportioned costs was extended with the addition of the following items:

- traction current;
- electricity supply to stations;
- station cleaning;
- BR joint working agreements;
- information assistants' staff costs;
- uniforms issued;
- staff taxis;
- safety and accommodation `Quick Fix' projects; and
- 1990/91 wage award (9.75 per cent).

FIGURE 5

Crossrail in 2001: crowding on the Underground (morning peak)



Source: LT Rail Planning, September 1990.

42. The results of the line contribution system are reported by four-weekly period, both for individual lines and for LUL as a whole. Table 8 summarises the Central Line and All Lines Contribution Statements for 1989/90 and the first nine periods of 1990/91. Operated train mileages and costs per mile at this level are also indicated.

TABLE 8 **Summary and analysis of Line Contribution Statements**

£ *million*

	1989/90		*1990/91 Periods 1 to 9*	
	Central Line	*All lines*	*Central Line*	*All lines*
Operated train miles (m)	4.92	31.80	3.57	23.30
Traffic income	73.8	416.6	57.1	331.6
Other income	4.8	29.9	3.6	22.3
Total income	78.6	446.5	60.7	353.9
Cost of operations				
Stations	15.5	85.2	15.6	92.4
Train operating	14.4	79.3	15.8	84.3
Fleet maintenance	10.1	58.9	8.1	46.9
Line administration	1.9	7.3	1.1	6.0
Total	(41.9)	(230.7)	(40.6)	(229.6)
LGM's contributions	36.7	215.8	20.1	124.3
Adjustments for revenue and costs outside LGM's control				
Traffic income resulting from other parties' operations	6.7	47.9	7.6	41.3
Allocated costs, etc	(0.6)	(3.1)	(0.7)	(4.2)
Total	6.1	44.8	6.9	37.1
Total net line contributions	42.8	260.6	27.0	161.4
Costs per operated train mile (£)	8.52	7.25	11.37	9.85
Performance ratios				
LGM's contributions as percentage of total income	46.7	48.3	33.1	35.1
Traffic income as percentage of cost of operations	176.1	180.6	140.6	144.4
Operating ratio, ie cost of operations as percentage of traffic income	56.8	55.4	71.1	69.2

Source: MMC from LUL data. Performance ratios, MMC.

At traffic income level the Central Line accounted for 17.7 per cent of the LUL total in 1989/90 and 17.2 per cent in the first nine periods of 1990/91, while at LGM contribution level it accounted for 17.0 per cent and 16.2 per cent respectively. Annex 1 shows 1989/90 figures uplifted by LUL to 1990/91 prices on the basis of the RPI.

43. Both for the Central Line and for all lines the three performance ratios shown in Table 8 are to date less favourable for 1990/91 than for 1989/90, reflecting, LUL explained, the additional devolution of the items listed in paragraph 41. We were also told that the lower figures shown in the table for the costs per operated train mile for all lines as compared with the Central Line reflected the wide range of variables which characterised the operation of LUL's ten markedly different line businesses.

Management information systems

44. The Central Line management consider that the current MISs do not adequately support their needs because they were built to support the previous functionally-based organisation. With the concurrence of the Head of IT they have therefore taken a lead in developing new, low-cost, PC-based systems. Different ways of aggregating data to form MI and performance indicators are being tested cheaply to determine the line's information needs. These simple information systems will act as prototypes for more robust and

advanced systems which can be used by each of the ten line businesses. Central's MISs will extend access to on-line information to all its senior managers and centurion managers. It will also significantly enhance the information that is available on-line compared with the existing EIS (see paragraph 5.41), by replacing the previous paper-based data collection system with one based on the direct input of primary data, eg by signalmen recording each train movement as it occurs on their PCs.

Manpower and industrial relations

Staff numbers and productivity

45. At 30 September 1990 staff numbers on the Central Line totalled around 2,290, including 325 train operators, 320 booking clerks, 302 leading railmen and 426 guards: the line has not yet been converted to OPO. Management plan to reduce staff numbers by 200 during 1991/92, as part of their efficiency proposals which to a large extent obtain the benefits from the successful introduction of UTS, by ceasing no-/low-value activities, eg by closing booking offices during periods of low demand. The management estimated that significant future productivity improvements were possible, subject to fundamental changes in working conditions and practices. Among these were an estimated 45 per cent improvement in train staff utilisation, following the introduction of OPO and new rolling stock, and comparable improvements among station and train maintenance staff.

Pay

46. Central Line management may reward increased productivity by management staff through the performance-related pay process but, for the most part, are unable to vary pay rates negotiated centrally with the trade unions. They expressed the view that the current LUL pay system had many shortcomings, including inadequate correlation between business performance and performance-related pay awards; bonus schemes for train maintenance staff which offered limited incentives and acted as constraints on achieving improved output; and difficult and expensive pay administration due to the complexity of the current grade and pay structure.

Industrial relations

47. The Line Personnel Manager is responsible for manpower forecasts and plans, training and development of line staff, staff communications and local industrial relations issues. He also chairs meetings of Sectional Council No 2 and is a member of the station staffing JWP. He expressed criticism of centralised recruitment and training procedures but envisaged that with continuing devolution much more would be done locally in the future. Currently there is around a 10 per cent annual movement of staff to other stations and lines, largely due to centralised recruitment policies and the PT&R Agreement which allows staff to transfer to locations nearer their homes after six months' service. Morale is reportedly low, especially among train staff, and staff remain to be convinced of recent organisational and structural changes.

Recruitment and training

48. Recruitment and training, though undertaken corporately, increasingly involve the line management-the Line Personnel Manager determines recruitment needs and arranges open days and other local initiatives. While the majority of staff training is undertaken by RTC some local training is provided, particularly in station fire and evacuation procedures and in customer care.

Absence

49. Despite the attention being paid to the control of absence, overall rates appear to be on the increase- from 6.5 per cent in 1988/89 to 7.0 per cent in 1989/90. The line business plan showing absence rate targets of 5.4 per cent for 1990/91, 4.3 per cent for 1991/92 and 3.8 per cent thereafter may be optimistic.

Maintenance

Rolling stock

50. The overall arrangements for the maintenance of rolling stock are described in paragraphs 8.8 to 8.60. The Central Line has two depots, Ruislip and Hainault, at the west and east ends of the line. Ruislip is the larger depot with some 200 staff, and carries out heavy overhauls, shed day and casualty lifting. The Hainault depot, with about 150 staff, concentrates on programme lift work. Both depots carry out 12-/14-day examinations and casualty repair work; and for stock stabled overnight they undertake the nightly tests and cleaning. Stock is also stabled etc at White City, Woodford and Loughton.

51. Breakdown services are provided by two specialist breakdown groups, based at Ealing Common and Neasden. These groups attend emergencies at any location on the railway as required, and at other times carry out maintenance work at the depot at which they are based. Any failure or incident as a result of which a train is unable to continue its journey unaided is treated as a breakdown and one or both groups travel to the scene by road with their specialist equipment.

52. The Central Line's Fleet Manager is based at Ruislip and there is a Depot Manager at Hainault. Both depots are organised on similar lines with two departments, workshop and conciliation. The workshops are staffed by supervisors, craftsmen (electrical fitters, mechanical fitters, bodymakers, coach painters, trimmers and welders), three grades of train maintainer and unskilled janitorial staff. Work undertaken includes heavy overhaul, programme lift, shed day and casualty repair. Casualty repairs range from the more complex repairs, usually those requiring diagnostic skills and, possibly, the use of test equipment, to the changing of defective equipment such as wheelsets or traction motors. Staff in the conciliation department include supervisors, three grades of train technician, two grades of train cleaner and depot office assistants. This department carries out:

- nightly safety tests;
- 12-/14-day examinations;
- rectification of simple faults;
- reform tests of trains;
- upkeep of maintenance records; and
- train cleaning.

The senior train technicians also respond to calls to attend trains in service when defects occur and are located at various points along the line.

53. Workshop staff work days only, on a 7.30 am to 4.00 pm shift. Allowing for their one-hour meal break at midday and a 10-minute break in the morning, the available time per man is 7.33 hours. Our consultants carried out detailed studies over two consecutive days at each depot.

54. At Ruislip the observations covered shed day and heavy overhaul work. These indicated that on shed day work, of the available time 45.5 per cent was productive, 44.3 per cent waiting for work and 10.2 per cent personal time. The high proportion of time waiting for work was due to the late arrival of the train on the second day. This accounted for 31.8 per cent of the total available time. For heavy overhaul work the observations showed that 74.1 per cent of available time was productive, 2.1 per cent waiting and 23.8 per cent personal time. A similar study of programme lift work at Hainault indicated that 52.8 per cent of available time was productive, 35.6 per cent waiting and 11.6 per cent personal time. In this case it was noted that the ten-man gang stopped work at 3.00 pm on the first day and had completed the task by 2.00 pm on the second day. No other work was done.

55. Our consultants' studies also covered the conciliation department and included day and night shift work on 12-/14-day examinations. At Ruislip depot two staff on night shift were occupied for 44 per cent of attendance hours, while three staff on day shift were occupied for 60 per cent of attendance hours. Three staff at Hainault depot on day shift were occupied for 74 per cent of the time. Observation of cleaning staff at Ruislip on both day and night shift indicated that the allocated work was completed well within the standard hours allowed.

Availability and reliability

56. Table 8.2 shows for the first eight periods of 1990/91 the percentage of scheduled morning peak trains cancelled because no rolling stock was available. For both morning and evening peaks, the scheduled service on the Central Line (excluding the shuttle) requires 72 trains; over the same eight periods the average number of cancellations was as shown in Table 9.

TABLE 9 **Average number of scheduled Central Line peak trains cancelled because no rolling stock was available, first eight periods of 1990/91**

	Period							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
am peak	1.7	2.4	1.0	2.2	2.8	1.3	1.6	2.1
pm peak	2.2	1.9	1.2	1.8	1.6	1.4	1.6	1.7

Source: LUL.

57. Reliability is monitored in terms of defects giving rise to delays in service of at least two minutes and is reported as incidents per 10,000 passenger train miles. Table 8.3 shows the unreliability due to rolling stock for the five years from 1985/86. Table 10 summarises all causes of unreliability for the Central Line for the same period.

TABLE 10 **Central Line delays of 2 minutes or more per 10,000 passenger train miles, all causes, 1985/86 to 1989/90**

	1985/86	*1986/87*	*1987/88*	*1988/89*	*1989/90*
Rolling stock	2.21	1.90	2.40	2.17	3.71
Other engineering	0.19	0.20	0.13	0.17	0.30
Traffic	3.50	4.80	5.17	5.01	5.00
Operational	0.19	0.25	0.36	0.45	0.73
External causes	2.37	2.61	2.57	2.19	3.34
Total	8.46	9.76	10.63	9.99	13.08

Source: LUL.

Other maintenance

58. As described in Chapter 8, all maintenance apart from rolling stock is at present the responsibility of the central Engineering Directorate. However, responsibility for day-to-day and routine maintenance of track and signalling, together with the appropriate staff resources, is to be transferred to the line businesses after April 1992 (see paragraph 3.24).

Metropolitan Line

Historical background

59. The Metropolitan Line runs from Aldgate to Amersham with branches to Chesham, Watford and Uxbridge. It includes the oldest section of underground railway in the world, running from Paddington to Farringdon, opened on 10 January 1863. This was extended to Moorgate by December 1865 and reached

Aldgate in 1876. Westward extensions, coupled with the opening of the Metropolitan District Railway in stages between 1868 and 1884, resulted in the development of the Circle Line. In 1868 a branch from Baker Street to Swiss Cottage was opened, reaching Harrow-on-the-Hill by 1880. By the turn of the century the Metropolitan Line had reached beyond Aylesbury to Verney Junction and Brill. The branches to Chesham, Uxbridge and Watford were opened in 1889, 1904 and 1925 respectively. Electrification began in 1905 and was completed in 1960, at which time the track between Harrow and Moor Park was quadrupled as part of a modernisation programme which included the introduction of the `A' stock trains still in use today. Also at that time the line beyond Amersham was transferred to BR.

60. Until 1988 the Metropolitan Line included the lines from Paddington to Hammersmith (opened in 1864) and Aldgate to Whitechapel (reached in 1884), with services subsequently extended through to Barking, as well as the East London Line from Shoreditch to New Cross and New Cross Gate. However, with the creation of LUL's ten line businesses both the Hammersmith to Whitechapel services, combined with Circle Line services, and the East London Line were each formed into a separate business unit.

The route

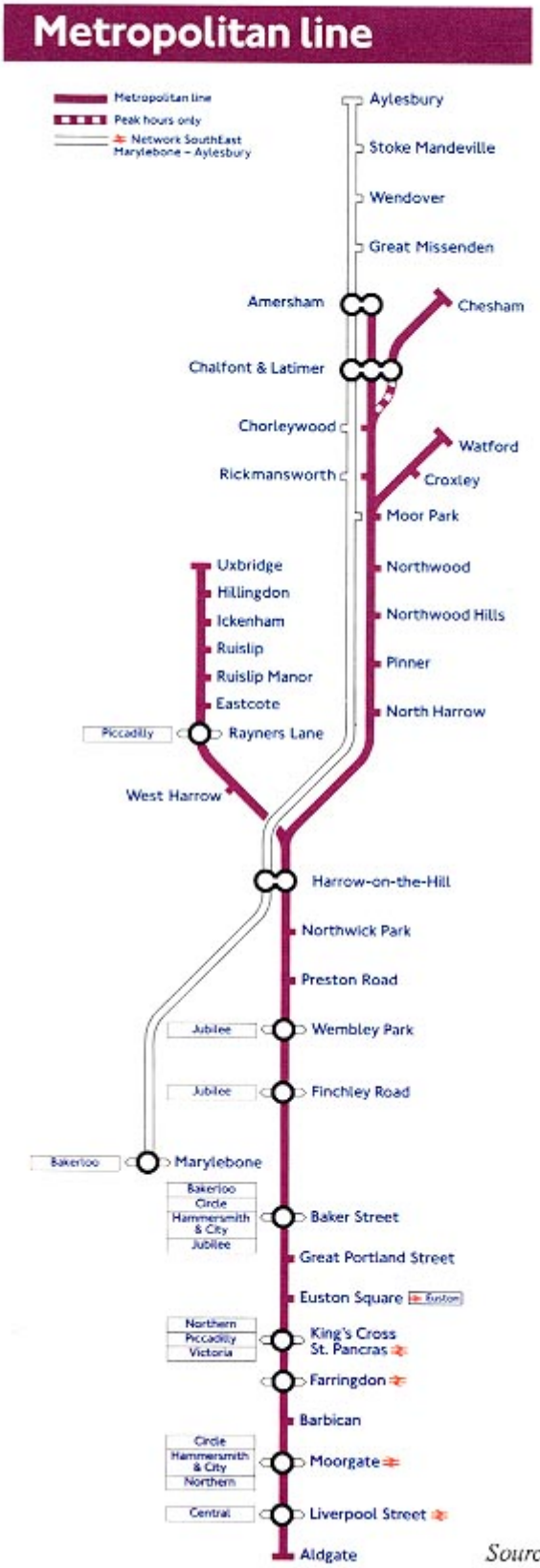
61. The present Metropolitan Line operates along a route of 41.5 miles and serves 32 stations. A schematic map is provided at Figure 6. In the City area the tracks run through `cut and cover' tunnels while from north of Baker Street to Finchley Road the tracks are in single-bore tunnels. Beyond that point the line is in the open. Between Harrow-on-the-Hill and Moor Park the line is four-tracked and, despite some steep gradients, this section is the fastest on the Underground. To the north of Moor Park the line branches to Watford and is reduced to two tracks; the branch from Chalfont and Latimer to Chesham is single-track.

62. Between Baker Street and Aldgate the Metropolitan Line shares tracks with the Hammersmith and City and Circle Lines. From Finchley Road to Wembley Park it runs parallel to the Jubilee Line, which serves the intermediate stations. The Uxbridge branch from Harrow-on-the-Hill operates along the same track as the peak-hour Piccadilly Line service west of Rayners Lane. Interchanges with LUL lines are at Baker Street (Jubilee and Bakerloo Lines); Finchley Road and Wembley Park (Jubilee Line); King's Cross/St Pancras (Northern, Piccadilly and Victoria Lines); Moorgate (Northern Line); and Liverpool Street (Central Line). For BR services the main interchanges are at King's Cross/St Pancras and Liverpool Street, with others at Moorgate and Farringdon. Interchange with BR Chiltern Line services running from Marylebone is possible at Harrow-on-the Hill, Moor Park, Chalfont and Latimer and Amersham.

Competition from other transport operators

63. The main competition to the Metropolitan Line is from BR, which runs a service from Aylesbury to Marylebone, sharing the tracks between Amersham and Harrow-on-the-Hill. The BR stock is old but has a more comfortable ride and BR is currently investing heavily to improve this service. Planned works include new signalling, train protection, driver-only operation, modified track and new Networker trains which could be introduced during 1991. Once delivery is complete, BR proposes to run an improved service with a peak interval of 16 minutes, probably running `non-stop' between Chorleywood and Marylebone. About ten years ago there was a fairly steep rise in the cost of LUL travel and some traffic was lost to coaches from Amersham and Chesham. However, there are now on average three coaches per day and the coach company concerned has no plans to increase this frequency. In the City the Metropolitan Line runs parallel to BR's Thameslink service between Moorgate and King's Cross. However, the BR section between Farringdon and Moorgate operates during peak hours only and competition is not significant.

FIGURE 6



Source: LUL.

Rolling stock

64. The rolling stock used on the Metropolitan Line is of the A60 and A62 types which entered service between June 1961 and December 1963. The stock is made up of 112 four-car units with a driving motor car at each end and two trailer cars in the middle. Six units are required for use on the East London Line, leaving 106 units available for Metropolitan Line services. For all but the Chesham branch services they are operated as two units coupled together to form eight-car trains. For the morning and evening peaks 41 such trains are used. In addition a single unit operates throughout the day on the Chesham branch. In the off-peak, the number of trains required reduces to 21 over the midday and evening off-peak periods.

65. The units of both the A60 and A62 types were formerly fully interchangeable. However, conversion to OPO in 1985 resulted in some loss of flexibility as not all driving cabs were fitted with radios (and the other necessary modifications, such as door controls and public address): only cabs fitted with a radio can be used at the outer end of trains.

Quality of service

Timetable revision in May 1990

66. The Metropolitan Line timetable formerly provided a direct service to the City in peak hours only; passengers for the City at other times were therefore required to change at Baker Street. The line management considered that their service would be more attractive if direct trains ran to the City all day and at weekends. An additional advantage would be a 40 per cent increase in the combined Hammersmith/Circle/Metropolitan service between Baker Street and Aldgate. Passenger time savings were estimated using the TSM and revenue benefits totalling £1.16 million per annum were predicted, compared with additional costs of £624,000 per annum. Approval to introduce the change was given by the LUL Board in January 1990 and the new timetable came into operation in May 1990.

67. A wide range of complex criteria required to be satisfied, including dovetailing the new timetable into the Circle and Hammersmith and City Line services. The new timetable was constructed with the aim of aiding operational reliability. A number of factors helped in this direction, such as longer turnround times at Uxbridge for the Metropolitan Line and at Hammersmith for the Hammersmith and City Line, which increased the capacity to recover from delays. The initial experience of operating the new service has been encouraging. A full appraisal is being conducted by comparing quality of service statistics and train loadings and analysing the train-running information provided by the signalling computer. First indications show a growth in traffic of about 7 per cent relative to the rest of the system. Some `fine tuning' of the timetable will be made in July 1991.

68. Table 11 shows examples of the weekday train service intervals on the Metropolitan Line.

TABLE 11 **Examples of Metropolitan Line weekday train service intervals, October 1990**

Minutes

	Morning peak (southbound)	*Midday off-peak*	*Evening peak (northbound)*	*7.15 pm to 9.30 pm*
Amersham line				
Fast	16	30	16	30
Semi-fast	16	-	16-28	-
Chesham branch	26-32	30	30-34	30
Watford line				
Fast*	4-16	-	5-16	-
Slow	16	15	10-20	15
Uxbridge line				
Fast	16	-	16	-
Slow	5-12	15	6-14	15
Harrow-Wembley Park	4-7	7-8	4-8	7-8
Through-City service	4	5-10	4	5-10

Source: LUL.

*Includes the Amersham semi-fast service.

69. Timetabled journey times from Amersham to Aldgate vary from 56½ minutes before the morning peak to 60 minutes at the height of the morning peak. The effect of peak congestion is thus to add 3½ minutes to the scheduled journey time.

Performance indicators

70. A range of performance targets is set annually for each LGM covering:

- service, customer and staff safety;
- service quality;
- service quantity;
- financial contribution;
- staff performance;
- asset performance; and
- business planning.

A number of different indicators are used to measure operating performance on a four-weekly basis throughout the year. Where appropriate the performance indicators and targets are disaggregated to line level, as are the customer satisfaction indicators (see paragraphs 14.5 and 14.7). The LGMs' targets are increasingly orientated towards these customer satisfaction measures.

Mileage operated

71. Figure 2 showed the mileage operated by each of our two case study lines as a percentage of scheduled mileage since 1980. The long-term performance of the Metropolitan Line closely follows that of the network as a whole until 1984/85; since then the line has tended to outperform the rest of the Underground by this measure.

72. In 1989 each of the line businesses was set a target of operating at least 96 per cent of scheduled mileage (as distinct from the network target of 98 per cent). Table 12 shows the recent performance of the Metropolitan Line against this target.

TABLE 12 **Proportion of scheduled mileage operated: Metropolitan Line**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*per cent Target*
Peak				
Metropolitan Line	94.7	95.6	95.5	96
All lines	92.1	90.1	92.3	98
Off-peak				
Metropolitan Line	99.1	99.3	99.3	96
All lines	97.2	96.0	96.9	98
Total				
Metropolitan Line	97.6	98.0	97.9	96
All lines	95.5	94.0	95.4	98

Source: LUL.

The Metropolitan Line's performance exceeds the targeted off-peak scheduled mileage and is close to meeting the peak target. On both measures it continues to better the network average by a significant margin.

Reliability

73. Figure 3 showed the excess waiting time performance of each of our two case study lines from 1986/87 compared with the network average excess waiting times. In the case of the Metropolitan Line the data are based on sampled observations of waiting times at Rickmansworth, Rayners Lane, North Harrow, Finchley Road, Great Portland Street and King's Cross. The line has consistently outperformed the network average; there is also some indication that the adverse trend between 1986/87 and 1989/90 may now have been reversed.

74. Table 13 shows the recent reliability performance of the Metropolitan Line and demonstrates that this is also better than that of the network as a whole when judged against the DTp target.

TABLE 13 **Reliability: Metropolitan Line**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target*
% chance of waiting more than 1.5 times the scheduled interval between trains				
Metropolitan Line	5.1	4.5	6.4	7
All lines	8.6	10.1	9.5	7
Average wait (minutes)				
Metropolitan Line				
Scheduled	4.9	5.0	4.9	-
Excess	0.7	0.5	0.8	-
Actual	5.6	5.5	5.7	-
All lines				
Scheduled	2.5	2.5	2.5	-
Excess	0.8	1.0	0.9	-
Actual	3.3	3.5	3.4	-

Source: LUL.

Peak capacity and peak crowding

75. Table 14 shows performance against the DTp target of increasing peak services by 5 per cent compared with 1988 service levels, which was to be achieved by April 1992. The significant increase in the peak service operated since the first quarter is due to the greater reliability provided by the new timetable and an improvement in rolling stock availability.

TABLE 14 **Percentage change in peak trains operated: Metropolitan Line (compared with same quarter in 1988/89)**

per cent

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*	*Target*
Metropolitan Line	-1.2	+1.2	+6.2	-
All lines	+2.0	+6.1	+7.3	+5

Source: LUL.

76. The probability of travelling in an overcrowded train at peak times on each of our two case study lines since 1986/87 was shown in Figure 4 and recent performance on the Metropolitan Line is shown in Table 15. The increase in peak-hour crowding on the Metropolitan Line this year is in part due to increased passenger demand attracted by the improved timetable (see paragraph 77).

TABLE 15 **Probability of travelling in an overcrowded train at peak times**

per cent

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Metropolitan Line	6	5	16
All lines	27	24	27

Source: LUL.

Customer satisfaction with train service

77. Regular customer satisfaction surveys enable LUL to examine its performance on two parts of the Metropolitan Line, the `main line' into Baker Street and the City section east of Baker Street. Table 16 shows the recent customer satisfaction ratings (see footnote to paragraph 14.31) for customers leaving stations on these two parts of the line compared with the rest of the system.

TABLE 16 **Customer satisfaction ratings: Metropolitan Line (out of 100)**

	Quarter 1 1990/91	*Quarter 2 1990/91*	*Quarter 3 1990/91*
Service frequency			
Metropolitan Line:			
Main line	33	35	39
City	29	36	31
Whole line	31	35	36
All lines	35	39	42
Crowding in trains			
Metropolitan Line:			
Main line	34	31	32
City	22	23	28
Whole line	26	27	30
All lines	19	18	21

Source: LUL.

78. The service frequency satisfaction rating is a more sensitive indicator than the service regularity satisfaction rating and appears to measure overall satisfaction with the reliability and frequency of the train service. It is apparent from Table 16 that customers using the Metropolitan main line have become markedly more satisfied with the quality of their train service in recent months. Passengers on both sections of the Metropolitan Line are significantly more satisfied with the level of crowding on their trains than those on other parts of the system.

Overall quality of train service

79. Generally, the Metropolitan Line's performance has been above average over the years. Problems were experienced during the mid- to late-1980s when the combination of new signalling installed between Wembley Park and Baker Street, the introduction of OPO and a requirement to increase the scheduled number of trains culminated in severe congestion between Baker Street and Aldgate, causing regular late running. Since the new timetable was introduced in May 1990 the quality of service has improved.

80. Each of the Metropolitan Line business areas is undertaking initiatives to improve performance. As part of the Total Quality programme the City area has been designated the `zone of innovation', a scheme which aims to break down barriers between staff and management and between functions by bringing people to work together in groups and generate ideas. The scheme has resulted in a number of initiatives including:

(a) *King's Cross garden*-A disused station was cleared of redundant materials by local staff. A flower garden was then established to show that the area was `cared for' and to prevent further dumping.

(b) *Passenger information scheme*-An `Area Information Assistant' now monitors the train and station services in the area and disseminates information to passengers. Publicity leaflets are also now distributed at stations.

(c) *Single queuing*-Several ticket-issuing windows now service a single queue.

(d) *Safety posters*-Posters now provide information to passengers on what to do in emergencies.

Graffiti

81. An extensive anti-graffiti painting project costing £560,000 was carried out during 1989/90 at 14 stations, principally north of Harrow. As a result graffiti at these stations have become more manageable.

Passenger information

82. Dot matrix indicators are provided on many Metropolitan station platforms in the City area, and new service information television monitors at Baker Street station provide basic train arrival/ destination information. The line staff are undergoing training to become aware of customer needs and management consider that most improvement has been made in the attitude of the train operators to providing on-train information, under both normal and emergency conditions.

Business Goals

83. The Metropolitan Line achieved its Business Goal 1 target of one cancellation or less per peak period on most days in January 1991. However, the adverse weather conditions in February 1991 resulted in an average of five cancellations per peak period for most of that month and a corresponding average of four in March. By April 1991 the target was again being achieved. As to Business Goal 2, the Metropolitan Line has no lifts and comparatively few escalators. While not directly responsible for performance, it reported that escalator availability improved from 86 per cent at the beginning of 1990/91 to 96 per cent at the end of that year. For Business Goal 3 the Metropolitan Line monitors its performance using the `Market Place Performance Reports' in preference to the customer satisfaction surveys. The Market Place Performance Reports are provided for individual stations and cover all important aspects of service through the customer's eyes. Scores in excess of 70 per cent have been achieved. In relation to Business Goal 4 the line business, at present, has very little direct influence.

Evidence from third parties

84. Comments relating to the Metropolitan Line were received from four user groups and five individual members of the public. Lack of Government support was specifically criticised by one user group in relation to fares levels; and by one member of the public, in part, in respect of a gradual deterioration in the quality of the service provided-here better management and greater union co-operation were also considered essential to improve the service. Two user groups argued for a statutory requirement for LUL to have regular consultations with local authorities so that public opinion could be taken into consideration before taking decisions such as that to close the north entrance to Rayners Lane station.

85. One user group thought that the general appearance of many of the stations remained unsatisfactory despite the recent repainting of, and graffiti removal from, stations. Complaints about particular stations related to Harrow-on-the-Hill, which was said to be badly run, with no staff on the platforms and no train service announcements when really required, eg for cancellations; Amersham and Wembley Park, said to lack indicator boards; and Baker Street, because the display boards indicated trains due but not their position in the timetable. One member of the public also thought that LUL did not pay enough to attract staff in affluent areas such as Amersham.

86. Another member of the public complained of a high level of fares evasion on the Metropolitan Line-at Harrow-on-the-Hill station tickets were not checked between LUL and BR platforms; moreover on-train inspections were no deterrent unless people were challenged as to why they had not bought tickets. Two user groups suggested that staff at UTS gates could collect tickets as part of their duties, so providing a better service to the public and relieving the worries of those who feared using the gates.

87. One member of the public considered that lack of staff had obliged LUL to reduce the timetable to the level of a Saturday one of a few years ago, yet there were still cancellations resulting in long gaps between trains. Moreover the timetable had been changed three times in the last year; and a lack of LUL/BR connections often meant having to travel through Central London on journeys between Hammersmith and Amersham: cross-London trains should be more frequent. Better planning of destinations and times of trains was also thought necessary by another member of the public.

88. One member of the public believed there should be increased expenditure on rolling stock, track and signalling rather than on station decoration. One user group also considered that refurbishment of the antiquated rolling stock was absolutely essential and that track and signalling, though basically safe, were in urgent need of substantial improvements, particularly to life-expired equipment on some sections of the line. Another user group commented that West Hampstead station's two bridges were not kept in good repair and that one required strengthening.

89. Operational improvements were suggested by one user group and two members of the public. These included moving southwards by a few hundred yards the junction on the southbound tracks to the south of platforms 5 and 6 at Wembley Park station; support for proposals both to divert the Metropolitan Line at Croxley via the BR branch into Watford and to reopen the reversing platform at Liverpool Street station so that trains could terminate there, relieving the pressure at Aldgate; the linking of services to Watford and Uxbridge with BR services starting from Blackfriars; the closure of Aldgate station and extension of the line first to Aldgate East and then south-east to take over the East London Line; the take-over of some BR routes thought to be more suited to Underground operation, eg the Bexleyheath line to Slade Green; the `disentangling' of the Metropolitan and District Lines; operation by BR of the Moor Park-Amersham section; and the lengthening of platforms to accommodate ten-car trains.

Investment

90. Baker Street station underwent extensive renovation during the 1980s (on the Circle Line platforms) as did King's Cross station (particularly to the Northern Line platforms and ticket hall) following the 1987 fire. In the past three years CCTV cameras have been installed in all public areas of Baker Street, King's Cross and Liverpool Street stations, allowing continuous monitoring of crowding levels, and the station PA systems have also recently been modernised at all stations which are wholly or partly under ground.

Supply and demand

91. In 1981 33.9 million passengers travelled on the Metropolitan Line, representing 272 million passenger miles, an average of 8 miles per passenger. By 1988 passenger numbers had increased by 47 per cent to 49.8 million, compared with an increase of 50 per cent for the Underground overall. The lower increase for the Metropolitan Line reflects the already heavy loading on the line from the west in 1981. Passenger journeys increased further to 50.6 million by 1990.

92. The demand for Metropolitan Line services varies by section of route and time of day. Table 17 shows the density of demand at different times of day on different sections of the route north of Baker Street as estimated in 1987 (the last year for which detailed figures are available).

93. Demand is highest between Harrow-on-the-Hill and Baker Street, where the total daily flow of passengers varies between some 71,000 and some 92,000, with the highest demand on the section of route between Wembley Park and Finchley Road. North of Harrow-on-the-Hill demand falls with the distance from London. The total also shows the highly peaked nature of demand. The demand on the busiest section of line in the evening peak is nearly four times the demand between the peaks; and demand in the peaks is very much concentrated either in the southbound (morning) or the northbound (evening) direction.

94. Table 18 shows the frequency of service offered on different sections of the Metropolitan Line north of Baker Street at different times of day, as at October 1990.

TABLE 18 **Trains per hour at different times of day,* October 1990**

	Morning peak	*Between peak*	*Evening peak*	*Evening*
Chalfont-Moor Park	Up to 7	2	Up to 6	2
Watford-Moor Park	Up to 8	4	Up to 8	4
Moor Park-Harrow-on-the-Hill	Up to 15	6	Up to 14	6
Uxbridge-Harrow-on-the-Hill	Up to 11	4	Up to 11	4
Harrow-on-the-Hill-Baker Street	Up to 26	10	Up to 25	10

Source: MMC based on LUL data.

*In addition BR trains call at Chalfont and Latimer, Chorleywood, Rickmansworth, Moor Park, Harrow-on-the-Hill and Marylebone.

95. The `delivered' capacity of the Metropolitan Line will be enhanced by minor modifications to the signalling at Aldgate, where too much reversing of trains causes delays, and particularly by the relocation of the Baker Street Circle and Hammersmith train-crew depot to Edgware Road, alleviating the serious delays at the critical Baker Street junction which can be caused by crew relief problems. Also under consideration are resignalling schemes to reduce the headways on the north side of the Circle Line and improving signalling control. A scheme to enhance the operational capacity of the critical converging junction south of Wembley Park was recently implemented. In addition an analysis is being undertaken of a number of proposed schemes for emergency crossovers to improve the service during times of disruption. Track quality improvements and the easement of speed restrictions are also in the early study stage.

TABLE 17 **Metropolitan Line: comparison of supply and demand by section of route north of Baker Street (1987 estimates)***

Section of route	*Passengers per hour*												*Passengers per day*
	Morning peak (7 am-10 am)			*Between peak (10 am-4 pm)*			*Evening peak (4 pm-7 pm)*			*Evening (7 pm-10 pm)*			
	South-bound	*North-bound*	*Total*	*South-bound*	*North-bound*	*Total*	*South-bound*	*North-bound*	*Total*	*South-bound*	*North-bound*	*Total*	
Chalfont/Latimer-Chorleywood	924	52	976	103	146	248	170	1,068	1,238	31	175	206	8,749
Rickmansworth-Moor Park	1,461	71	1,532	209	179	388	249	1,800	2,049	39	311	350	14,123
Croxley-Moor Park	347	55	402	78	50	128	99	400	499	13	41	54	3,637
Moor Park-Northwood	1,970	132	2,103	281	237	519	379	2,348	2,727	61	375	436	18,909
North Harrow-Harrow-on-the-Hill	4,188	228	4,416	553	506	1,059	592	4,173	4,765	123	795	919	36,652
Uxbridge-Hillingdon	510	359	869	339	353	692	558	611	1,169	94	94	188	10,824
West Harrow-Harrow-on-the-Hill	3,072	268	3,340	588	635	1,223	642	2,911	3,553	157	470	627	29,899
Harrow-on-the-Hill-Northwick Park	8,123	723	8,847	1,327	1,276	2,603	1,114	8,028	9,142	383	1,480	1,863	75,171
Wembley Park-Finchley Road	10,867	787	11,654	1,796	1,811	3,607	1,453	10,439	11,891	468	1,955	2,423	99,543
Finchley Road-Baker Street	10,003	707	10,710	1,501	1,667	3,167	1,257	9,390	10,647	489	1,706	2,194	89,656

Source: MMC based on LUL data.

*The morning and evening peak figures are averages and understate the level of demand during the busiest peak hour.

96. Future demand is forecast to be affected by BR's complete route modernisation of the Aylesbury-Marylebone line, causing an increase in the traffic currently transferring from BR to LUL at Marylebone, and some passengers to forsake LUL for BR services at Harrow-on-the-Hill. Traffic losses are also forecast from Farringdon and King's Cross as BR's Thameslink services (here running parallel to the Metropolitan Line) are developed. The introduction of the Liverpool Street- Paddington Crossrail is forecast to result in a reduction in demand. For example, demand is forecast to drop by 191,535 passenger miles in the three-hour morning peak, a fall of some 25 per cent.

97. Management efforts to promote usage of the off-peak service to the City for leisure purposes followed the introduction of the improved May 1990 timetable and are planned to be repeated this summer. School visits and educational compacts, customer `surgeries', newsletters, leaflet racks, suggestion boxes and postcard-type community advertising are other means by which the services are promoted.

Financial results

98. As from the beginning of 1989/90 LUL adopted a line contribution approach to its financial reporting. The principal features of this approach are that:

(a) identifiable and controllable costs;

(b) cash takings from sale of tickets, adjusted to an accruals basis;

(c) other traffic income distributed on an algorithmic basis; and

(d) apportioned costs

are identified with the individual line businesses.

99. Following the introduction of a new General Ledger and Chart of Accounts in January 1990, the range of both directly attributed and apportioned costs was extended with the addition of the following items:

- traction current;
- electricity supply to stations;
- station cleaning;
- BR joint working agreements;
- information assistants' staff costs;
- uniforms issued;
- staff taxis;
- safety and accommodation `Quick Fix' projects; and
- 1990/91 wage award (9.75 per cent).

100. The results of the line contribution system are reported by four-weekly period both for individual lines and for LUL as a whole. Table 19 summarises the Metropolitan Line and All Lines Contribution Statements for 1989/90 and the first nine periods of 1990/91. Operated train mileages and costs per mile at this level are also indicated.

TABLE 19 **Summary and analysis of Line Contribution Statements**

£ million

	1989/90		*1990/91 Periods 1 to 9*	
	Metropolitan Line	*All lines*	*Metropolitan Line*	*All lines*
Operated train miles (m)	3.04	31.80	2.31	23.30
Traffic income	46.9	416.6	38.1	331.6
Other income	5.5	29.9	3.8	22.3
Total income	52.4	446.5	41.9	353.9
Cost of operations				
Stations	11.5	85.2	12.9	92.4
Train operating	7.6	79.3	9.4	84.3
Fleet maintenance	7.0	58.9	5.8	46.9
Line administration	0.7	7.3	0.5	6.0
Total	(26.8)	(230.7)	(28.6)	(229.6)
LGM's contributions	25.6	215.8	13.3	124.3
Adjustments for revenue and costs outside LGM's control				
Traffic income resulting from other parties' operations	13.9	47.9	10.7	41.3
Allocated costs etc	(0.4)	(3.1)	(0.6)	(4.2)
Total	13.5	44.8	10.1	37.1
Total net line contributions	39.1	260.6	23.4	161.4
Costs per operated train mile (£)	8.82	7.25	12.38	9.85
Performance ratios				
LGM's contributions as percentage of total income	48.9	48.3	31.7	35.1
Traffic income as percentage of cost of operations	175.0	180.6	133.2	144.4
Operating ratio, ie cost of operations as percentage of traffic income	57.1	55.4	75.1	69.2

Source: MMC from LUL data. Performance ratios, MMC.

At traffic income level the Metropolitan Line accounted for 11.2 per cent of the LUL total in 1989/90 and 11.5 per cent in the first nine periods of 1990/91, while at LGM contribution level it accounted for 11.9 per cent and 10.7 per cent respectively. Annex 1 shows 1989/90 figures uplifted by LUL to 1990/91 prices on the basis of the RPI.

101. Both for the Metropolitan Line and for all lines the three performance ratios shown in Table 19 are to date less favourable for 1990/91 than for 1989/90, reflecting, LUL explained, the additional devolution of the items listed in paragraph 99. We were also told that the lower figures shown in the table for the costs per operated train mile for all lines as compared with the Metropolitan Line reflected the wide range of variables which characterised the operation of LUL's ten markedly different line businesses.

Management information systems

102. The Metropolitan Line has inherited MISs designed for the old functionally-based LUL organisation which have not been found to be entirely compatible with the line's needs. All information systems are currently being reviewed and developed and the Central Line's PC-based systems may be adopted when available.

Manpower and industrial relations

Staff numbers and productivity

103. Total staff on the Metropolitan Line rose to a peak of 1,610 early in 1990/91, reflecting full establishment, temporary staffing for safety checks and a variety of training initiatives. Staff numbers are now declining, reflecting LUL's financial constraints, and will fall still further as a result of recently announced cuts. At 30 September 1990 staff totalled around 1,542, including 263 train operators, 260 booking clerks and 244 leading railmen. Various productivity improvements have been made in recent years, notably the introduction of OPO in September 1986. Performance is measured on a four-weekly basis as part of the business report cycle, comparing staff numbers with revenue, contribution and mileage and also monitoring sickness and absence rates.

Pay

104. Pay rates and employment conditions are negotiated on a central basis with the trade unions; however, locally there is scope to reward increased productivity by management staff through the performance-related pay process.

Industrial relations

105. The Line Personnel Manager is responsible for the collation of the four-weekly staff statistics forming the first part of LUL's manpower planning process. He is also responsible for staff communications, including the line newsletter *Metnews*, for staff administration and casework and for the implementation of absence, sickness and disciplinary procedures. He chairs meetings of Sectional Council No 6, while also representing the interests of PSD, and takes part in various JWPs.

Recruitment and training

106. Recruitment and training, though undertaken corporately, increasingly involve the line management-the Line Personnel Manager determines recruitment needs and arranges open days and other local initiatives. While the majority of staff training is undertaken by RTC some local training is provided, particularly in station fire and evacuation procedures and in customer care.

Absence

107. Close attention has been paid in recent years to the monitoring and control of absence. The line business plan indicates a declining trend from an overall rate of 6.9 per cent in 1989/90 to a forecast 6.2 per cent in 1990/91 and 4 per cent thereafter. However, the actual incidence of absence, based on central statistics, shows a rising trend from an overall rate of 5.5 per cent in 1988/89 to one of 8.3 per cent in 1989/90.

Maintenance

Rolling stock

108. The overall arrangements for rolling stock maintenance are described in paragraphs 8.8 to 8.60. On the Metropolitan Line there is one main depot, located at Neasden, together with several minor depots and sidings where rolling stock is stabled, eg Wembley Park and Rickmansworth. The Fleet Manager, based at Neasden, has some 300 staff and is responsible for the maintenance of rolling stock for the Metropolitan, Jubilee and East London Lines. In total this comprises 56 eight-car trains of A60/62 stock and 31½ six-car trains of 1983 tube stock. The organisation of Neasden depot and the work undertaken are similar to the Central Line main depots (see paragraphs 50 to 52).

Availability and reliability

109. Table 8.2 shows for the first eight periods of 1990/91 the percentage of scheduled trains cancelled in the morning peak because no rolling stock was available. The equivalent average numbers of cancellations for the Metropolitan and East London Lines in both the morning and evening peaks are shown in Table 20.

TABLE 20 **Average Metropolitan and East London Lines scheduled peak trains cancelled because no rolling stock was available, first eight periods of 1990/91**

	Period							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
am peak	3.2	1.6	1.4	1.5	1.3	0.6	1.1	0.5
pm peak	3.8	1.7	1.6	2.1	1.4	0.6	1.1	0.6

Source: LUL.

110. Table 8.3 shows, for a five-year period, the number of delays of 2 minutes or more per 10,000 passenger train miles caused by defective rolling stock. The equivalent delays from all causes over this period are shown in Table 21 (in addition to the Metropolitan Line these figures include the Hammersmith and City and Circle and the East London Lines).

TABLE 21 **Delays of 2 minutes or more per 10,000 passenger train miles, all causes, 1985/86 to 1989/90**

	1985/86	*1986/87*	*1987/88*	*1988/89*	*1989/90*
Rolling stock	1.53	2.06	1.78	2.78	4.48
Other engineering	0.30	0.28	0.47	0.65	0.77
Traffic	3.10	3.13	3.74	4.15	4.77
Operational	0.15	0.15	0.39	0.50	0.56
External causes	2.05	2.74	2.63	2.60	3.48
Total	7.13	8.36	9.01	10.68	14.06

Source: LUL.

Other maintenance

111. As described in Chapter 8, all maintenance apart from rolling stock is at present the responsibility of the central Engineering Directorate. However, responsibility for day-to-day and routine maintenance of track and signalling, together with the appropriate staff resources, is to be transferred to the line businesses after April 1992 (see paragraph 3.24).

112. Most of the Metropolitan Line route is in the open. It includes the fastest section of track (Harrow-on-the-Hill-Moor Park) on the whole LUL network. However, the route is at present subject to an overall speed restriction of 50 mph imposed in October 1989 because of the condition of the track.

Line Contribution Statements: 1989/90 uplifted to 1990/91 prices

	Central Line		*Metropolitan Line*		*All lines*	
Operated train miles (m)	4.92		3.04		31.80	
Traffic income		81.2		51.6		458.3
Other income		5.3		6.1		32.9
Total income		86.5		57.6		491.2
Cost of operations						
Stations	17.1		12.7		93.7	
Train operating	15.8		8.4		87.2	
Fleet maintenance	11.1		7.7		64.8	
Line administration	2.1		0.8		8.0	
Total		(46.1)		(29.5)		(253.8)
LGM's contribution		40.4		28.2		237.4
Adjustments for revenue and costs outside LGM's control						
Traffic income resulting from other parties' operations	7.4		15.3		52.7	
Allocated costs etc	(0.7)		(0.4)		(3.4)	
Total		6.7		14.9		49.3
Total net line contributions		47.1		43.0		286.7
Costs per operated train mile (£)	9.37		9.70		7.98	
Performance ratios						
LGM's contribution as percentage of total income		46.7		48.9		48.3
Traffic income as percentage of cost of operations		176.1		175.0		180.6
Operating ratio, ie cost of operations as percentage of traffic income		56.8		57.1		55.4

Source: LUL. Performance ratios, MMC.

APPENDIX 2.2
(referred to in paragraphs 2.7, 2.14, 3.9, 3.39, 3.70, 8.123, 11.3, 14.3 and 14.116)

Safety

Introduction

1. LRT has a statutory duty to have due regard to safety of operations in carrying out its functions; LUL is also bound, in particular, by the Railways Acts and Health and Safety at Work legislation (see Chapter 2). Accordingly safety on the Underground was always a major concern of management prior to the King's Cross fire of November 1987. However, the public inquiry chaired by Sir Desmond Fennell QC[1] provided a catalyst for profound and far-reaching change in all areas of LUL's activities, from operations, training and engineering to investment and R&D into fire prevention. From being generally *reactive* to safety issues, learning empirically and reacting to shortcomings as they were revealed, LRT and LUL have become *pro-active* in their approach and attitude to safety. Safety has become a corporate objective and is now the first item on the agenda at every LUL Board meeting. The following paragraphs chart the most significant progress and achievements of the past three years or so and highlight the impact on LUL's structure, organisation and performance. Supplementary details may be found in the appropriate chapters of our report.

Changes since 1987

2. Immediately after the King's Cross fire LUL held an internal inquiry; and in addition to the Fennell Inquiry and Report a number of other external bodies (some commissioned by LUL) produced evidence and reports leading to numerous recommendations for improved safety standards and safety management. All recommendations were carefully considered and some 700 were incorporated by LUL into a Safety Improvements Programme controlled and monitored, for the time being, by a Safety Programmes Unit. A second special unit, the Rail Engineering Safety Co-ordination Unit, was set up to co-ordinate engineering actions resulting from the regular safety inspection reports of the Railway Inspectorate and LFCDA.

3. A management reassessment undertaken as part of the Strategic Review between mid-1987 and mid-1988 revealed that there had been a gradual rundown of the standards and well-being of LUL's assets, notwithstanding LUL's investment programme for infrastructure renewal. Expenditure on asset maintenance was increased in aid of implementing a maintenance strategy based on new safety standards, comprehensive specifications and performance criteria.

4. The LRT Board committed itself to a policy of reducing the number and severity of accidents and to attaining standards in safety and health equal to, or better than, those achieved by equivalent organisations elsewhere in the world. In November 1988 an LRT Board Safety Audit Committee, supported by a Safety Audit Unit, was set up, under the chairmanship of a non-executive member, to monitor compliance by LRT and its subsidiaries with their statutory duties regarding the safety, health and welfare of employees and the public. The LRT Chairman and Chief Executive is a member of the committee, which meets monthly and reports to the Board. At about the same time a non-executive director with expertise, and a special interest, in safety matters was appointed to the LUL Board. He chairs the LUL Board Safety Committee, the terms of reference of which are provided at Appendix 3.1, and serves also as a member of the LRT Board Safety Audit Committee.

5. Also at that time the LUL Safety Programmes Unit was consolidated within a new Safety Services organisation led, since January 1989, by a Head of Safety Services recruited externally. The new post-holder sits on both the LUL Board Safety Committee and the LUL Executive Committee. The Safety Services Department is now well established with over 20 safety professionals recruited both externally and from within LUL. Its work has concentrated on establishing a safety advisory service to executive directorates, setting safety standards, monitoring the Safety Improvements Programme and, more recently,

[1] See the report, `Investigation into the King's Cross Underground Fire' (the Fennell Report), published on 10 November 1988.

introducing a new incident notification and investigation procedure and establishing a formal Safety Management System (see paragraph 13).

6. On 1 February 1989 LRT published its formal response to the Fennell Report, accepting 125 of the 127 recommendations addressed to LRT/LUL (see paragraph 8). LRT was directed to submit quarterly reports to the Secretary of State on progress in implementing the recommendations. Also in compliance with the Fennell Report the Railway Inspectorate investigated LUL's safety management at stations and published in May 1989 a report which assessed LUL's safety systems against the International Safety Rating System (ISRS) (see paragraph 13). LUL has formally adopted ISRS for self-assessment and the Railway Inspectorate is currently carrying out a further safety audit which began in January 1991.

7. A major impact on LUL has been made by the Fire Precautions (Sub-Surface Railway Stations) Regulations 1989, made under section 12 of the Fire Precautions Act 1971. These required the implementation at 115 stations of stringent and wide-ranging fire fighting and precautions measures, including installing fire detection, alarm and sprinkler systems; fire compartmentation and emergency escape plans; improved communications systems; staff training; and use of fire-resistant materials. These `section 12' regulations came into force generally on 18 September 1989, although some provisions carried effective dates of 1 January 1990, 1 January 1991 and (in the case of one provision, relating to the material used to construct escalator steps) 1 January 1996. Enforcement is the responsibility of LFCDA. LUL assembled a special project team to implement its Section 12 Fire and Safety Works Programme.

8. In December 1989 special safety objectives set by the LRT Board and formally endorsed by the Secretary of State[1] were published:

> The Board of LRT confirms that the highest priority will be given to the promotion of the safety, health and well-being of all employees and passengers. This will be facilitated by:
>
> *(a)* The development of specific quantified safety statistics for LRT and its subsidiaries against which will be set measurable improvement targets.
>
> Targets will be set for all subsidiaries by the end of 1989. To assist in raising standards, appropriate systems will be used in the major subsidiaries. London Underground have already introduced the International Safety Rating System (ISRS) of safety audit ...
>
> *(b)* The issue and active internal publicity of revised health and safety policy statements and organisational arrangements for LRT and its subsidiaries.
>
> LRT's general policy statement and all major subsidiary additional statements have been agreed. Statements for the remaining, non-operational areas will be agreed by the end of 1989.
>
> *(c)* Consistent and meaningful reporting to the LRT Board of accidents, assaults and potentially dangerous occurrences from all subsidiaries.
>
> The format and frequency of these reports have been defined.
>
> *(d)* The maintenance of a vigorous safety audit programme to monitor progressive improvement.
>
> The LRT Safety Audit Unit has completed five safety audits, and an annual plan will be approved to programme work. LRT's subsidiaries are also implementing their own safety audit programmes.

[1] Letter from the Secretary of State for Transport to the Chairman of LRT dated 20 December 1989. A further letter of 19 April 1990 explicitly stated that safety should be LUL's top priority, notwithstanding the financial objectives set for it by the Secretary of State in the letter.

In LRT's 1989/90 annual report and accounts, which for the first time included a special section on safety, the Chairman was able to report that `considerable progress' had been achieved against LUL's objectives by dint of investing `an enormous amount of management time and capital expenditure'. In the specific case of the Fennell Report, 125 of the 127 recommendations for action had been or were in the process of being implemented.[1] LUL's extensive safety programme had been its `first priority' during the year and had involved the development of a genuine safety culture across the company.

9. LRT's 1989/90 annual report also referred to:

- the issue in July 1989 of a new LUL policy statement covering the health and safety of employees and the public;

- the development of a standard format for the reporting of quantified safety statistics by LUL to the LRT Board, along with the setting of measurable improvement targets. For 1990/91 an employee injury frequency rate improvement target of 15 per cent[2] had been set for LUL and the LRT Board was equally determined to continue to improve passenger safety;

- an independent report into safety aspects of LUL's new UTS gates which had suggested some improvements (including automatic opening of the gates on activation of the smoke and fire alarms) but found that the gates provided more evacuation routes than the previously fixed installations and did not impede access for the emergency services;

- evaluation by LUL of all 93 of the recommendations made in the report of Sir Anthony Hidden QC into the BR train crash at Clapham Junction;[3]

- the undertaking during the year of several studies into quantifying risks and analysing the possibilities for accident, and the implementation of the resulting recommendations to improve safety standards further; and

- the setting down by the LRT Board of specific corporate safety objectives for 1990/91.

10. The 1990/91 LRT corporate safety objectives included:

(a) a measurable improvement in overall safety performance;

(b) consolidation of existing safety work and expenditure programmes, and ensuring effective implementation;

(c) progress towards the cost-effective internal generation of accident and loss prevention programmes; and

(d) ensuring that LRT's enhanced safety culture extended to all employees.

---

[1]The two exceptions were those for a deep-level interchange subway at King's Cross and for staff to have radio pagers- Parliamentary approval was being sought for the construction of the interchange; and instead of radio pagers staff now have personal radios, which have proved of immense operational and security benefit at major stations.

[2]Shortly afterwards this target was revised to 14 per cent. However, no such improvement was achieved. At the end of 1990/91 the employee injury frequency rate was higher than for the previous year, owing to an unexpected rise in the number of assault injuries. If these injuries are excluded from the calculation the 14 per cent target was met.

[3]The Hidden Report into the Clapham Rail Disaster, published on 7 November 1989 (see paragraph 14.117). The report recommended the submission direct to the Railway Inspectorate of six-monthly progress reports on the implementation of its recommendations and the Railway Inspectorate is following progress as part of its regular contact with LUL.

11. In May 1990 LUL's policy statement of July 1989 was complemented by the publication of *Your Ticket to Safety*, a document widely issued to its customers. And LUL's Business Goals, adopted in June 1990, included a five-year asset maintenance and renewal programme (see paragraph 14.8).

12. LUL published its Corporate Safety Action Plan 1990/91 and is soon to publish its plan for 1991/92. LUL's directorates have established individual Safety Action Plans as a mechanism to monitor and control all progress against the Safety Improvements Programme.

13. LUL's Safety Management System (see paragraph 5) is based on the principles of ISRS, a major initiative in pro-active safety management auditing. It embodies a comprehensive set of safety standards against which improvement and performance may be measured and implementation will take up to ten years to complete.

14. Station Evacuation Plans have been produced for all stations and approved by LFCDA. There are also regular joint exercises with the emergency services, as required by the Fennell Report.

15. The organisational arrangements now in place for the management of safety within LUL may be summarised as follows:

(a) each LUL Board meeting reviews the Safety Committee minutes, together with a Safety Improvements Action Status Report and other submitted progress reports on all safety actions;

(b) the LUL Executive Committee makes recommendations to the Board on safety implications for the capital programme, reviews safety matters, including incident and audit reports, and ensures that recommended actions are carried out;

(c) the LUL Board Safety Committee meetings are attended not only by the relevant directors and the Head of Safety Services but also by the LRT Head of Medical Services and senior managers from PSD;

(d) a Safety Management Group, chaired by the Managing Director, has been established. The terms of reference for this group are provided at Appendix 3.2; and

(e) at the lower level, safety management is conducted through the Head of Safety Services Safety Management Meeting and other similar directorate meetings. However, safety is an integrated management function and all managers remain individually accountable for the safety performance of their own department. Regular monitoring is by means of LUL-wide safety tours by senior managers, as well as by safety audits.

Impact on other aspects of LUL's quality of service

16. Other aspects of LUL's quality of service have been adversely affected in the following main ways:

(a) stations are frequently closed and evacuated as LUL is required to summon LFCDA at the first sign of a fire or smell of smoke; where fires are suspected in tunnels this generally requires the discharge of traction current, with consequent disruption to train services (see paragraphs 14.118, 14.120 and 14.121);

(b) station closures are also increasingly used as a means of effecting crowd control and minimising congestion; and stations may be closed when there are insufficient staff in attendance to comply with section 12 requirements or to enable implementation of LUL's evacuation plans if required;

(c) work on removing fire-hazardous materials at many stations has been disruptive and had a detrimental effect on the passenger and staff environment;

(d) the availability of station escalators has been greatly affected, both directly by safety works and indirectly by the consequent difficulty in scheduling routine maintenance; and

(e) the availability of trains has been curtailed by their withdrawal from service for, in particular, a great deal of safety-related work, prototype refurbishment schemes primarily designed to eliminate hazardous materials and/or technical audits and consequent remedial work.

Impact on staff numbers and operating costs

17. The reversal of a downward trend in staffing levels since 1983 was another consequence of the King's Cross fire. LUL estimated that overall staff numbers had risen by 1,700 (9 per cent) at March 1990 as a result of safety and asset health considerations:

Additional operating staff	600
Additional depot staff for extra train cleaning	50
Additional engineering operations staff	800
Additional PSG, Client Engineering and Development Directorate	150
Additional police	100
Total	1,700

18. LUL also estimated that its operating costs had increased, at the same date, by some 8 per cent as a result of the implementation of safety-related improvements. Those changes which had had a major impact on revenue resources and expenditure were cited as:

- full station staffing;
- new Safety Services organisation;
- continuous staffing of Station Operations Rooms during traffic hours;
- training for fire safety, evacuation drills and emergency preparedness;
- regular station safety inspections;
- improvements to station cleaning and litter clearance;
- improvements to escalator cleaning and maintenance;
- improvements to vital station systems maintenance;
- lighting maintenance;
- improvements to pump, drainage and track maintenance;
- improvements to train maintenance, including new standards and specifications for maintenance activities;
- improved tunnel cleaning;
- additional maintenance, eg for new fire protection systems, extended PA systems, CCTV etc;
- increased incident reporting, inquiries and information gathering;
- inspection of electrical track connections and cables; and
- new Safety Management System.

Impact on LUL's investment programme and project expenditure

19. Safety projects requiring major investment are included within the UIP and executed individually. The need to comply with the section 12 regulations within the stipulated time-scales over and above other committed safety works presented a management and resource problem which was met principally through the use of external contractors under LUL project management. At December 1990 the total cost of complying with the legislation was estimated to amount to some £200 million. Achievement of the target completion dates and planning of the expenditure has been made more difficult by varying interpretations of the legislation.

20. Following the inclusion of safety (particularly fire safety) projects in the UIP, funding and resource constraints have had a major impact on the implementation and timing of non-safety-related projects; frequently it has proved impossible to avoid abortive work and unnecessary expenditure on such projects. Substantial resources have necessarily been diverted from planned programmes such as those designed to

effect productivity and efficiency improvements. LUL's safety project expenditure for 1990/91 is forecast to amount to some 43 per cent of its total project expenditure for the year (after excluding £36 million of expenditure on congestion relief from both the safety and total project expenditure). LUL stated that a balance had now been struck between safety expenditure and other essential investment, such as infrastructure renewals, `such that the maximum safety improvement can be achieved in the shortest possible time'.

21. Previously LUL had lacked the tools for adequate analysis of the case for safety improvements. Recently, however, the Safety Services Department has been developing quantitative hazard analysis-a systematic approach to assessing the probability and consequences of major incidents-the preliminary results of which are about to be published.

22. The priority which LUL has accorded to safety is now reflected in its investment priorities (see paragraph 11.11). Some safety projects, however, are of comparatively low priority and are classified in a residual, general safety improvements category. LUL told us that it considered risk assessment techniques particularly useful in relation to this category.

23. LUL is now committed to a more considered and measurable approach to safety expenditure and has recently adopted the following safety objectives:

(a) to demonstrate that safety is being achieved in a measurable way;

(b) to provide a target against which safety costs can be measured and justified;

(c) to enable section 12 requirements to be examined in a more critical light;

(d) to provide a means of justifying safety expenditure; and

(e) to demonstrate due diligence.

24. In support of this approach, in order to provide a quantifiable measure of safety performance LUL has begun work on a safety model based on a combination of historical LUL data and engineering and scientific judgment. With the completed model LUL expects to be able to progress to using predictive safety performance data, allowing critical areas to be highlighted and properly resourced.

APPENDIX 3.1
(referred to in paragraph 3.16 and Appendix 2.2, paragraph 4)

LUL Board Safety Committee

Terms of reference

1. The Committee's functions are:

(a) to make recommendations to the Board on London Underground's policy, objectives and organisation relating to safety in order to ensure that the Company fulfils its obligations to the public, passengers and staff;

(b) to ensure that safe operating procedures are documented and practised; that plant and equipment is designed as low risk and that employees and the general public are not exposed to risks greater than those tolerable on the best underground railway systems;

(c) to monitor safety performance and progress and recommend to the Board any action necessary to correct unacceptable trends. This will include consideration of issues raised by enforcing authorities and as a result of internal safety audits and inquiries and referring to the Board any failure to take appropriate remedial action within the timescale required;

(d) to encourage greater awareness of the importance of safety and higher achievement in safety performance;

(e) to seek additional outside advice, as considered necessary, to assist in the improvement of safety performance;

(f) to prepare reports on matters of safety as appropriate including reviewing the prioritisation of expenditure and investment in safety related projects and initiatives;

(g) to review quarterly reports on safety from the Managing Director for submission to the Board of London Regional Transport and the Department of Transport and the annual report on trends in fire and smoke incidents before submission to the London Fire Brigade and Railway Inspectorate.

Important functions of the safety committee

2. *(a)* To review safety performance relating to:

- passenger accidents
- service disruption
- lost time injury frequency rate
- duration rate
- recordable frequency rate (future)
- other appropriate safety performance indicators
- fires

(b) To give particular attention to reviewing congestion in stations so that reports of the most serious incidents can be made to the London Underground Board and Railway Inspectorate in line with Fennell recommendation 62.

(c) To compare the Company's performance in relation to other similar undertakings or industries.

(d) To review performance against objectives and targets.

(e) To regularly review procedures for dealing with and reporting of fires.

(f) To review safety planning annually and ensure that the overall implications are included in the annual strategic planning process.

(g) To review adequacy and effectiveness of internal controls and training for safety.

(h) To review safety incidents (near misses or incidents involving injury) of significance and ensure that corrective action is taken, also to identify common areas of concern in different incidents. Also to ensure that reporting and investigation procedures are followed relating to incidents and near misses where the safety of passengers, general public, third parties and staff was or could have been involved. This includes all areas of London Underground Limited operations.

(i) To monitor the cost to the Board of safety related incidents.

(j) To ensure that the Company's management employs the appropriate techniques to ensure that risks and hazards are properly evaluated.

(k) To provide a forum for exchange of information and experience on safety issues.

(l) To review compliance with statutory safety and health regulations on a sample basis.

(m) To review the organisational arrangements for safety and fire prevention.

(n) To review safety audit reports as appropriate.

Membership

3. The membership of the Committee is as follows:

Mr M H Vogel	-	Committee Chairman
Mr D Tunnicliffe	-	Managing Director
Dr P A M Diamond	-	Head of Medical Services
Mr M E Fish	-	Engineering Operations Director
Mr B Mellitt	-	Engineering Director
Mr R N Straker	-	Personnel Director
Mr A Osborne	-	Head of Safety Services
Mr R Mitchell	-	Safety Programmes Manager

In addition the following will be invited to attend the meetings of the Committee:

Two General Managers	-	Passenger Service Directorate (see note below)
An Engineering Manager		(see note below)

Note: These managers will be nominated for one-year terms on a rotating basis.

Procedure

4. *(a)* The Committee will normally meet four weekly or as determined by the Chairman, but will meet at least four times a year.

(b) The quorum for the Committee to be three Directors.

(c) The minutes of all Committee meetings will be submitted to the Board of London Underground Limited for noting.

(d) Particular problems can be advised directly to the Committee by individual members of staff with communications routed via the Head of Safety Services or Committee Secretary.

(e) At least two meetings annually should incorporate site visits to inspect safety problems/ facilities etc at first hand.

(f) The Board Safety Committee shall meet the Chief Inspecting Officer of Railways once a year to discuss safety performance and other matters as considered appropriate.

Source: LUL.

APPENDIX 3.2
(referred to in paragraph 3.16 and Appendix 2.2, paragraph 15)

LUL Safety Management Group: terms of reference

Introduction

1. A Safety Action Programme is being compiled to pull together all the initiatives to enhance the safety of the Underground system. The programme will cover:

(a) Safety in Stations

(i) response to the Fennell Report

(ii) obligations on the Company of the Regulations under Section 12 of the Fire Precautions Act 1971 (to be known as The Fire Precautions [Sub-surface Railway Stations] Regulations 1989)

(iii) other aspects, eg arising from research work such as system safety assessments, hazard analysis, etc.

(b) Safety of trains

(c) Safety of signalling

(d) Safety of track

(e) Safety of electrical systems

Control of safety action programme

2. The Managing Director will have overall responsibility for the programme and will exercise the necessary control through a Safety Management Group. The group will meet every four weeks and comprise:

Managing Director	Chairman
Development Director	
Engineering Director	
Finance Director	
Passenger Services Director	
Head of Safety Services	
Safety Programmes Manager	
Client Agent S1 11	Secretary

Responsibilities

3. The group will be responsible for:

(a) making recommendations to the Board on the extent and content of the Safety Action Programme;

(b) setting the relative priorities of the various safety initiatives;

(c) approving the annual budgets and five/ten year plans for specific safety investment;

(d) co-ordinating and integrating the safety initiatives with other work and in the longer term transferring them back into their rightful Major Project groups where appropriate;

(e) monitoring and progressing the various initiatives against progress and cost plans;

(f) the preparation of the monitoring reports on the implementation of the Fennell Report recommendations for submission to LRT and the Department of Transport;

(g) the liaison with the Home Office and London Fire Brigade on the implications, programme and progress of The Fire Precautions (Sub-surface Railways) Regulations 1989.

Source: LUL.

APPENDIX 3.3
(referred to in paragraph 3.17)

LUL Finance Committee: terms of reference

1. To review all project expenditure submissions which are in excess of the delegated authorities of individual Client Directors. The Committee will take into account in its deliberations all matters pertinent to the project, including operations, safety, marketing and personnel matters, but with particular reference to the financial implications, benefits and other effects.

The Client will normally attend the meetings of the Committee to present the project and answer questions.

2. To approve all project expenditure submissions which are in excess of the delegated approval authority of individual Directors, up to a limit of £2,000,000.

3. To review and make recommendations to the Board of London Underground Limited on projects over £2,000,000.

4. To propose guidelines under which all projects will be assessed, approved, monitored, and controlled.

5. To play a part in the monitoring and control of individual projects and the project programme as appropriate. In particular, to investigate cases where projects have exceeded approved authority by more than 10 per cent or completion dates by more than six months.

6. To consider and where necessary make recommendations to the Board on strategies for which major project expenditure submissions will arise.

7. To assist the Finance Director in monitoring and controlling the progress of the capital investment programme through the year.

8. To advise the Finance Director on general financial issues as appropriate.

Source: LUL.

APPENDIX 3.4
(referred to in paragraph 3.19)

LUL Executive Committee: terms of reference

1. To make recommendations to the Board on:

(a) bids for funding from London Regional Transport/Department of Transport;

(b) `layering' of the capital programme to accommodate different levels of capital availability;

(c) identify variations to meet objectives in the capital programme, having due regard to safety;

(d) annual budgets and budget guidelines;

(e) strategic planning issues and plans;

(f) performance compared with indicators set by the Board, including financial performance;

(g) Standing Orders;

(h) such financial and management progress reports as may from time to time be specified;

(i) Parliamentary Proposals;

(j) Annual Report and Accounts;

(k) fare levels and structures;

(l) significant service changes.

2. To review safety matters, including the review of incident reports and audit reports, and ensure that recommended actions are carried out.

3. To agree, where appropriate, policies and programmes for staff training and development.

4. To agree wage and salary levels.

5. To decide marketing strategies, reporting to the Board as necessary.

6. To ensure that appropriate standards of security are maintained throughout all aspects of Company affairs.

7. To ensure that budgets are realistic and make the best and most cost-effective use of available resources.

8. To review and agree strategic initiatives and major project groupings of investment items.

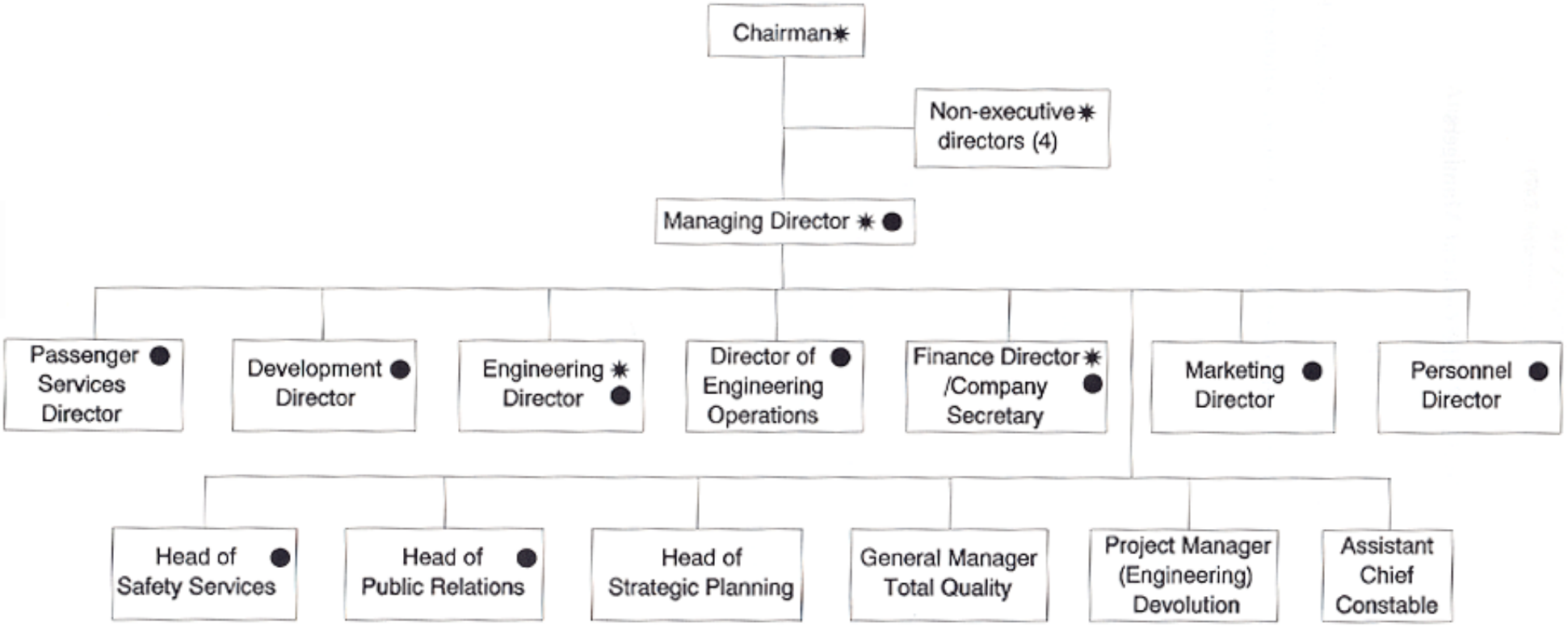
9. To review all matters concerning the day-to-day operation, maintenance and administration of London Underground Limited not covered by the above.

Source: LUL.

APPENDIX 3.5

(referred to in paragraphs 3.19 and 3.25)

LUL senior management structure


Chairman ✷
Non-executive ✷ directors (4)
Managing Director ✷ ●
Passenger Services Director ●
Development Director ●
Engineering Director ✷ ●
Director of Engineering Operations ●
Finance Director /Company Secretary ✷ ●
Marketing Director ●
Personnel Director ●
Head of Safety Services ●
Head of Public Relations ●
Head of Strategic Planning
General Manager Total Quality
Project Manager (Engineering) Devolution
Assistant Chief Constable
✷ Member of LUL Board
● Member of LUL Executive Committee

Source: LUL.

APPENDIX 3.6
(referred to in paragraph 3.47)

Duties of Line General Managers

Line General Managers' specific responsibilities are defined as:

- achieving financial performance targets, including revenues from secondary businesses;
- train and station services operation to volume, safety and quality performance targets;
- revenue protection;
- operational safety;
- staff management;
- train service timetable requirement specification;
- infrastructure and asset operational performance;
- Business Unit planning;
- specification of requirements for all other `bought-in' services;
- customer relations and line-based marketing specification;
- relations with external bodies; and
- incident management.

Source: LUL.

APPENDIX 4.1
(referred to in paragraph 4.14)

Analysis of forecast overrun, 1990/91

		£ million
Shortfall in budgeted traffic receipts		(13)
The major influences on continued lower level of traffic receipts have been adverse weather conditions, the impact of the Gulf War on tourism and business travel and the effect of the recession, particulary on Travelcard clearances with BR		
Operations cost overrun against budget		(32)
The budgeted saving on pension fund contributions, consequent on the actuarially determined surplus, was not fully realised because of unanticipated improvements in benefits	(17)	
Delay or failure to implement cost saving measures (eg no Boxing Day service)	(10)	
Increased depot maintenance cost due to continuing difficulties with wheel wear and traction motor modifications	(1)	
Increased energy costs because of bad weather	(1)	
Rent and rates higher than originally budgeted	(3)	
Overrun on project expenditure		(70)
The target expenditure of £340 million comprised Project Managers' expectations of £401 million less anticipated slippage of £61 million. Current forecasts are for an out-turn of £410 million and it is now felt unlikely that any significant slippage will arise. Unbudgeted works (for example, strengthening of the covered way at Blackfriars) and additional expenditure necessary to comply with section 12 requirements have offset the substantial deferrals made on other projects		
		(115)
Offsetting increases in creditors at year end		45
A substantial extension of credit taken, including a withholding of payments to the Pension Fund pending resolution of benefit revision, partially offset the overruns (see paragraphs 4.12 and 4.13 for discussion of the effect of this on 1991/92)		
Net total overrun		(70)

Source: LUL.

APPENDIX 4.2
(referred to in paragraph 4.14)

Comparison of achieved actual at period 12 with latest forecast out-turn for 1990/91

£ million

	Accumulated actual period 12	*Forecast out-turn 1990/91*	*Difference being amount available for period 13*
Income	533	576	43
Cost of operations (excluding revenue projects £22m)	(514)	(555)	(41)
Operational surplus (before depreciation and renewals)	19	21	2
Project expenditure (including revenue projects)	(382)	(410)	(28)
	(363)	(389)	(26)
Movement in working capital (a reduction of working capital which is either lower stocks and debtors or higher creditors or a combination of both represents a reduction in grant required)	53	69	16
EFL requirement	(310)	(320)	(10)

Source: LUL.

9. The working group is continuing to meet with a view to fine tuning the service later this year. The next major change is expected in May 1993 when the number of trains operating the peak service should be boosted to 30 to cater for the forecast increase in demand by increasing the service to 24 TPH. Sufficient trains should then be available following completion of the stock refurbishment programme.

APPENDIX 5.1
(referred to in paragraph 5.28)

Regular management information reports

			Recipients												
			LUL directors							*A typical*					
	LRT	*LUL Board*	*PSD*	*Engineering*	*Eng Ops*	*Develop-ment*	*Market-ing*	*Personnel*	*Finance*	*Line Gen Mngr*	*Unit Mngr Eng Ops*	*Client Engr*	*Prin Engr*	*Head of Dept*
Frequency/ document:														
Daily														
Trains in peak service		X	X			X			X					
Lift and escalator availability		X	X	X	X					X				
Weekly														
Traffic summary	X	X				X			X	X				
Noteworthy incident register	X	X	X	X	X	X	X	X	X	X	X	X	X	
4-weekly														
LUL business report	X	X	X	X	X	X	X	X	X	X	X	X		X
Directorate performance reports:														
PSD			X							X				
ED				X								X	X	
Eng Ops					X						X			
Development							X							X
Marketing								X						X

			LUL directors							*A typical*				
	LRT	*LUL Board*	*PSD*	*Engineering*	*Eng Ops*	*Develop-ment*	*Market-ing*	*Personnel*	*Finance*	*Line Gen Mngr*	*Unit Mngr Eng Ops*	*Client Engr*	*Prin Engr*	*Head of Dept*
Unit reports:														
PSD			X							X				
Eng Ops					X						X			
ED				X								X	X	
Safety performance report		X	X	X	X	X	X	X	X	X	X	X	X	
Finance director's commentary		X	X	X	X	X	X	X	X					
Wages drift report		X	X	X	X			X	X					
Live projects monitoring report			X	X		X	X	X	X			X		
Line contribution reports	X	X	X	X	X	X	X	X	X	X				
Quarterly														
LT service review	X	X	X	X	X	X	X		X	X				
Report to LT safety audit committee	X	X	X	X	X	X	X	X	X					
Analysis of fire incidents		X	X	X	X	X	X	X	X					
Progress in implementing Fennell rec	X	X	X	X	X	X	X	X	X					
Internal audit report		X	X	X	X	X	X	X	X					
Directorates' quarterly review		(MD) X	X	X	X	X	X	X	X	X	X	X	X	X
Annual														
Directorate annual reports		X												

Source: LUL.

APPENDIX 6.1
(referred to in paragraph 6.1)

Trade union membership at 6 September 1990, analysis by main function

Main staff group	*RMT*	*TSSA*	*ASLEF*	*EETPU*	*AEU*	*TGWU*	*BTOG*	*MSF*	*UCATT*	*Total members**	*Total members as % of LUL staff employed*
Trains	1,780	3	1,982	-	-	24	-	-	-	3,669	94.1
Stations (wages)	2,787	9	82	-	2	15	-	-	-	2,876	85.5
Stations (supervisory and booking offices)	987	1,472	119	1	2	20	-	-	-	2,541	90.9
Depot (wages)	722	-	-	58	84	29	-	-	-	956	90.0
Signal (wages)	919	-	-	1	-	1	-	-	-	920	88.2
Permanent way (wages)	1,403	-	-	-	-	1	-	-	-	1,403	96.1
Other	2,802	1,994	132	518	308	258	126	73	40	6,625	72.5
Total	11,400	3,478	2,315	578	396	348	126	73	40	18,990	84.0

Source: LUL.

*Includes members of some other unions.

APPENDIX 6.2
(referred to in paragraph 6.3)

RNC machinery: composition of Sectional Councils

The Sectional Councils shall consist of elected members of the staff as follows:

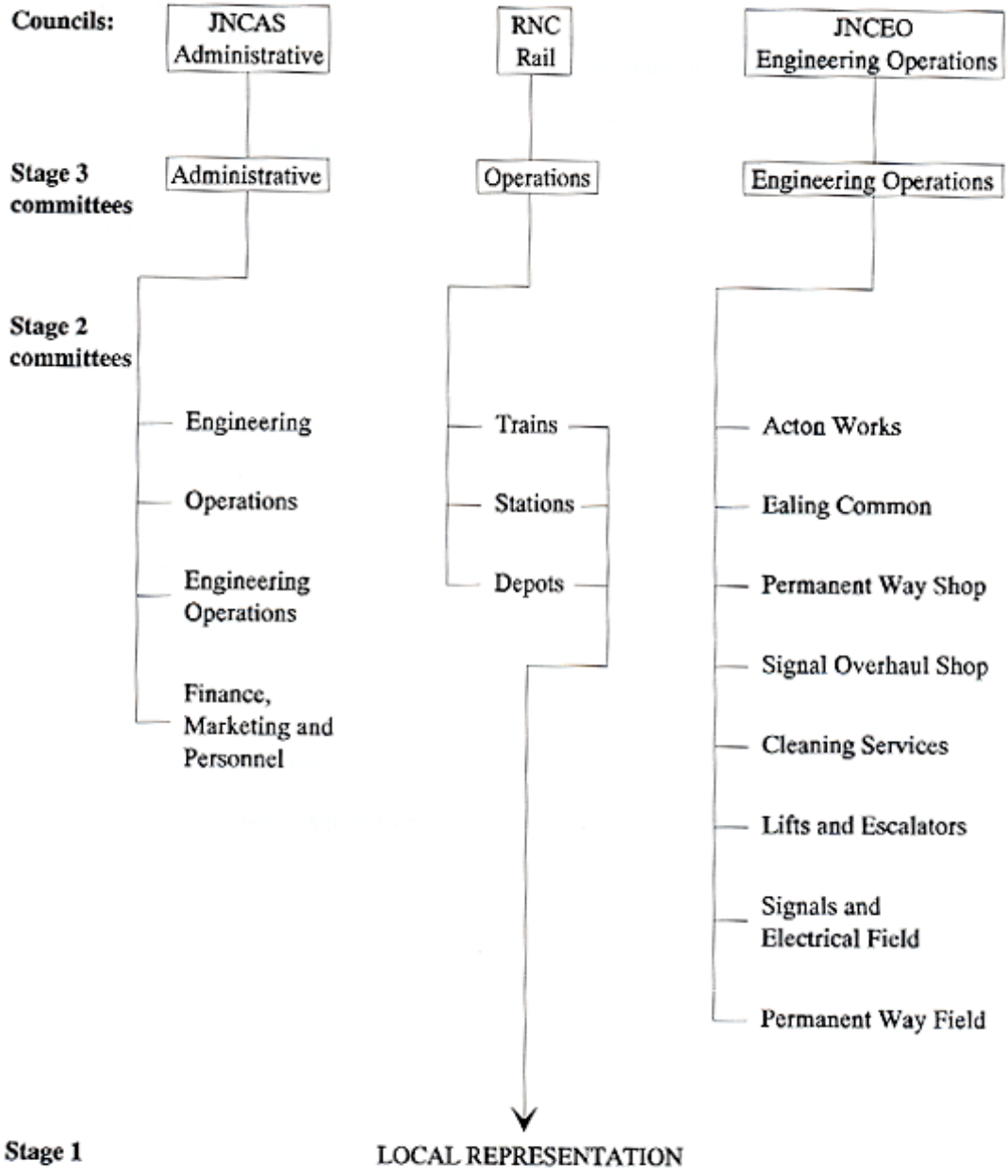
No of council	*Section*	*Number of representatives*
1	Clerical and technical staff	14-10 Clerical classes A, B and W(Spl.) and technical assistants 4 Senior clerical assistants and engineering assistants
2	Booking office staff	7-2 District 3 Tubes 2 Metropolitan
3	Train wages staff	11-2 District 5 Tubes 4 Metropolitan (1 Steam)
4	Station, etc, wages staff	10-2 District 4 Tubes 4 Metropolitan
5	Engineering supervisory staff	3-1 Civil 1 Signals 1 Mechanical
6	Traffic, etc, supervisory staff	6-1 District 2 Tubes 2 Metropolitan 1 Miscellaneous
7	Signal engineering wages staff	8-4 Signal maintenance 2 Signal installation and new works 1 Telephones 1 Cables
8	Permanent way engineering wages staff	9-2 District 3 Tubes (1 nights) 3 Metropolitan 1 Miscellaneous
9	Mechanical engineering wages staff	8-2 District 4 Tubes 1 Metropolitan 1 Lifts and escalators.

Source: LUL.

Note: Not more than a corresponding number of officials shall be nominated on behalf of the management. Only staff who are members of a trade union party to this agreement shall be eligible to make nominations for, or be nominated, or hold office as, staff representatives of a Sectional Council.

APPENDIX 6.3*(a)*
(referred to in paragraph 6.4)

Proposed new negotiating machinery



Source: LUL.

30. Journey options are made up of various components of time (walking, waiting, riding), a money cost and other less readily quantifiable features, such as perceived safety, comfort and so on. In the particular case of the Underground the generalised cost formulation has been developed to take account of a number of features. These are primarily the relative unattractiveness, when compared with riding, of walking, waiting and interchange and the unattractiveness of crowded conditions. Weightings are applied to the basic estimates of each component of the journey time, as follows:

In-vehicle time (seated)	1.0
Waiting time (uncongested)	2.0
Walking time (unimpeded)	2.0 (also applies to interchange times)
Interchange	Add 5 mins for each interchange
Crowding	1.42 (x + 0.048)-all lines except the Metropolitan*
	1.31 (x + 0.052)-Metropolitan Line*

where $x = \frac{\text{train load - train seats}}{\text{crush load - train seats}}$

*Additional penalty over and above in-vehicle time.

All these have been derived empirically, from observing Underground journeys where trade-offs are being made. The values represent broad averages derived from a wide range of individual values.

31. The aggregate forecasts of demand (in passenger miles) produced by the marginal models using elasticity concepts (see paragraph 9.17) include only one supply variable. This is waiting time for Underground trains. The empirically-derived waiting time elasticities in use at present are:

Peak	*Off-peak*
-0.22	-0.72

Thus an increase in off-peak waiting time has a much greater effect on demand than a change at peak periods.

32. The weightings given in paragraph 31 have been adopted in recent long-term planning studies, notably CLRS, and they are now built into DTp's LTS model.

33. Because of the complexity of the LTS model a full iterative procedure was not possible in CLRS. Simplifying assumptions were made, based on comparisons of uncongested and congested travel times, to estimate the effects of congestion. Particular difficulties were encountered on the highly-congested sections of the Central Line east of Liverpool Street in balancing traffic between LUL and BR lines.

34. LUL's Network Model includes the effects of congestion on the Underground both on rail links (on trains) and on walk links (passageways, escalators etc). In both cases the treatment of congestion is similar, namely demand is compared to capacity, the perceived time on the link is changed to reflect the prevailing conditions, and the model rerun, based on the revised travel times. The relationships used are empirically-derived and complex.

APPENDIX 6.3*(b)*
(referred to in paragraph 6.4)

Proposed new negotiating machinery: terms of reference and representation

Negotiating bodies	*Terms of reference*	*Representation*
Councils	Basic pay rates Working week Terms and conditions Interpretation of agreements Principles affecting two or more Staff Committees and referred by Stage 3 Committee Management.	Management: Personnel Director (Chair) Appropriate Directors Senior Managers Unions: Officials Executive Committee Members
STAGE 3 Committees	Matters referred by Negotiating Council. Appeal items from Stage 2 Committees.	Management: Appropriate Director or Senior Manager. Unions: Officials Lay representatives
STAGE 2 Committees	The settlement of issues referred from the local level. Work organisation, hours, reliefs, timekeeping, leave, allocation, rosters, seniority. Accommodation, Welfare and Amenities. Efficiency of operations and productivity. Publicity for rules and regulations. Health and Safety at work Matters. Matters referred. Matters of mutual interest affecting the well being of the staff or of operations.	Management: Appropriate Senior Manager and staff Unions: Lay representatives
STAGE 1	Local representatives may be arranged where appropriate, eg train staff. The terms of reference and membership will be proposed by the appropriate Stage 2 Committee and is subject to agreement by the appropriate Negotiating Council.	

Source: LUL.

APPENDIX 6.4
(referred to in paragraphs 6.8 and 14.19)

Summary of industrial action, 1980 to 1990

Date	*Reason*	*Group of staff involved*
7 March 1980	Assaults on staff	Hammersmith and City Line, Hammersmith to Royal Oak. Staff remained on duty, but refused to work for a period of two hours. Numbers involved not known.
18/19 and 25/26 April 1980	Assaults on staff	ASLEF and TSSA members. Numbers of staff involved not known.
14 May 1980	TUC Day of Action: Campaign for Economic and Social Advance	NUR members. Numbers involved not known.
10 November 1980	Failure of senior management to attend funeral of a colleague	Rickmansworth train depot. 19 staff involved, ten trains cancelled.
10 March 1982	TUC Day of Action	6,023 staff (out of 9,693)-station, train, booking office, and lift and escalator staff.
18/19 to 29/30 June 1982	Pay claim	All locations (RNC). PSD 3,561 (out of 8,880) per day. (Six days unofficial action; five days official action).
7 October 1983	Use of contract staff in telephone exchange rooms	Signal and Electrical Engineering, Communication staff-196 (out of 196), NUR.
28 February 1984	Support of GCHQ campaign	RNC and JNC staff 2,333.
15 May 1984	Lobby of the LUL executive, Acton Works	966 (out of 1,298). JNC wages staff, Acton Works.
27 June 1984	Support of mine workers	437 staff overall. 12 trains cancelled.
10 October 1984	Demarcation dispute	Power Division, 23 ESI staff (out of 36). (3/4 hour stoppage.)
20 May 1985	Plans to extend OPO	1,668 staff (7.5 per cent of workforce).
5 April 1989 to 10 August 1989	Train staff pay and conditions. Station staff conditions	14 one-day stoppages. Staff taking action ranged from 491 to 5,676.

Source: LUL.

APPENDIX 8.1
(referred to in paragraphs 8.3, 8.8 and 8.14)

LUL passenger rolling stock

Surface stock

Metropolitan and East London Lines	56	x 8	car trains of A60/A62 Stock
Circle and Hammersmith Lines*	46⅓	x 6	car trains of C69/C77 Stock
District Line	75	x 6	car trains of `D78' Stock

Tube stock

Northern Line†	3	x 7	car trains of 1956 Tube Stock
	75	x 7	car trains of 1959 Tube Stock
	2	x 7	car trains of 1962 Tube Stock
	1	x 3	car unit of 1962 Tube Stock
	25	x 7	car trains of 1972 Mark I Tube Stock
	1	x 3	car unit of 1972 Mark I Tube Stock
Central Line‡	83½	x 8	car trains of 1962 Tube Stock
	3	x 3	car trains of 1960 Tube Stock
Victoria Line	43	x 8	car trains of 1967 Tube Stock (includes 3½ trains of composite 1972 Mark I/1967 Tube Stock)
Bakerloo Line	33	x 7	car trains of 1972 Mark II Tube Stock
Piccadilly Line	87	x 6	car trains of 1973 Tube Stock
Jubilee Line	31½	x 6	car trains of 1983 Tube Stock

Source: LUL.

---

*Also used to operate District Line Edgware Road-Wimbledon service.

†1956/59/62 Tube Stocks are compatible with each other. 1972 Mark I Tube Stock is not compatible with 1956/59/62 Tube Stocks.

‡1962 Tube Stock is not compatible with 1960 Tube Stock (which is used to operate the Woodford-Hainault shuttle service).

APPENDIX 8.2
(referred to in paragraph 8.11)

Rolling stock depots

Bakerloo Line	Stonebridge Park depot
Central Line	Ruislip depot Hainault depot
Circle and Hammersmith Line	Hammersmith depot
District Line	Ealing Common depot Upminster depot
Northern Line	Golders Green depot Morden depot
Piccadilly Line	Northfields depot Cockfosters depot
Victoria Line	Northumberland Park depot
Metropolitan and Jubilee Lines	Neasden depot

Source: LUL.

APPENDIX 8.3
(referred to in paragraphs 8.12 and 8.35)

Scheduled train maintenance cycles

Line	*Stock*	*Examination (days)*	*Shed day (weeks)*	*Cycle: Programme lift (years)*	*Cycle: Heavy overhaul (years)*
Bakerloo	72TS II	14	30	3	9
Central	62TS 60TS }	12	18	1.5	9
Circle and Hammersmith	C69/77	14	30	2.5	9
District	D78	14	30*	4.5	9
Jubilee	83TS	14	30	4	9
Metropolitan (including East London)	A60/62	14	18	2	9
Northern	56/59TS 72TS I	12 14	18 30	2 3	6 9
Piccadilly	73TS	14	36†	4	9
Victoria	67TS	14	36	4	9

Source: LUL.

*Half shed day given at 15 weeks.
†Half shed day given at 18 weeks.

APPENDIX 8.4
(referred to in paragraph 8.12)

Scheduled maintenance of rotating machines

		Years
Traction motors		6
Air compressors	— reciprocating	4
	— rotary	3
Motor alternators/generators		6
Mechanical governors		2/3

Source: LUL.

APPENDIX 8.5
(referred to in paragraph 8.12)

Scheduled cleaning cycles

Line	*Stock*	*Water wash (days)*	*Exterior clean (weeks)*	*Interior clean (weeks)*	*Interior windows (weeks)*	*Cycle Vacuum (weeks)*
Bakerloo	72TS II	3	4	4	2	4
Central	62TS	3	6	6	3	3
	60TS					
Circle and Hammersmith	C69/77	5/6	3	5	2.5	5
District	D78	3	5	5	2.5	5
Jubilee	83TS	3	6	6	3	3
Metropolitan	A60/62	3	4	4	4	4
East London	A	6	4	4	4	4
Northern	56/59TS	3	5	5	5	5
	72TS I	3				
Piccadilly	73TS	3	6	6	3	6
Victoria	67TS	3	8	8	3	2

Source: LUL.

APPENDIX 8.6
(referred to in paragraph 8.85)

Engineers' train fleets

`Owned' by Engineers Train Manager

Pre-1985 battery locomotives	41
1985 battery locomotives	6
Flat wagons (1931 to 1966)	40
30-ton GP wagons (1985)	41
30-tonne hopper wagons (1981)	26
40-tonne high deck wagons (1987)	6
20-ton rail wagons (1931 to 1965)	16
20-tonne rail wagons (1985)	26
Concrete mixer/match wagons (1987)	3
Cable turntable wagons	3
Cable drum wagons (1940)	3
Long welded rail trains	3
1922 Metropolitan Electric Locomotive `Sarah Siddons'	1
Rolls Royce diesel locomotives	3
Unimog road/rail vehicles (1983 and 1985)	2
Tube pilot cars (1927/1934)	4
Match wagons (1935 to 1965)	7

`Owned' by Permanent Way Engineer

Plain line tamping machines (1980)	3
6-ton cranes (1955 to 1964)	3
7.5-ton cranes (1982 to 1984)	4
10-ton track relaying machine (1986)	1
Tunnel cleaning train	1
Track recording train	1
Weedkilling train	1
Gauging car	1

Source: LUL.

APPENDIX 8.7
(referred to in paragraph 8.129)

Inventory of premises and structures

Asset type			*Quantity*
Bridges:	underbridges		312
	overbridges		264
	bable bridges		189
	footbridges		404
	culverts		81
Viaducts		km	8.8
Covered ways			103
Girderings			308
Pipe crossings			291
Brick tunnels		km	25.0
Tube tunnels:	concrete	km	33.4
	cast iron	km	206.4
Signal gantries			126
Retaining walls			854
Stations			248
Shafts:	cable		67
	ventilation		248
	pump		70
	lift		73
Machine rooms			121
Spiral staircases			55
Disused stations			20
Electrical substations			117
Depots and works			22
Power stations			2
Lighting:	tower		4
	high mast		75
	standards		2,875
Embankments and cuttings		km	285
Track drainage		km	582

Source: LUL.

APPENDIX 9.1
(referred to in paragraphs 9.10, 9.16, 9.39 and 14.55 and Appendix 1.1, paragraph 7)

Demand: information, modelling and forecasting

Information collected on demand

1. LUL uses a variety of methods to collect data on demand. At the broadest level, ticket revenues are used as a basis for estimating travel. Weekly revenues are monitored closely by LUL and are the main indicator used to track short-term changes in demand. Most other data are collected or estimated on an annual basis.

2. Until the early 1980s a reasonably accurate picture of traffic could be built up from ticket sales alone. But the introduction of Travelcards and a zonal fares structure has made precise estimation of the number of passengers on the Underground on any particular day, and the journeys which they are making, extremely difficult. A monthly, all-zones Travelcard purchased at one station can be used to travel any number of times between any pairs of stations during its period of validity. Revenue earned at the point of sale does not describe the potential pattern of use.

3. It is, therefore, necessary for LUL to build up a picture of travel patterns on the system from a set of passenger surveys. These provide sample data describing a number of features about the use of the system from which an overall estimate can be made. There are five categories of data available:

(a) sales data;

(b) passenger counts;

(c) UTS gate data;

(d) passenger surveys; and

(e) O-D surveys.

Sales data

4. Sales data are available from the various ticket outlets, primarily Underground stations, BR stations and newsagents. Sales by ticket type, categorised by fare value and zonal combinations, are available for each type of outlet. By making assumptions about usage of various types of ticket, based on the surveys described below, LUL uses sales data to monitor changes over time.

Passenger counts

5. A one-day count of passengers entering each station is conducted each spring. A few stations are counted on each day of the survey, although each station is counted for only one weekday. Observations are recorded in 15-minute intervals during the period 7 am to 10 pm. Less frequent counts are carried out at weekends and *ad hoc* counts are carried out where specific information is required about a particular location. A morning peak period exit count is carried out at central area stations each autumn, as part of a broader survey aimed at monitoring travel into Central London by all modes.

UTS gate data

6. The data capture potential of UTS gates is considerable. So far, approximately 60 stations have UTS gates and LUL estimates that 75 per cent of passengers pass through these gates, 50 per cent of them at both ends of their journeys. The recording mechanism can produce counts by period and by ticket type. LUL reports that the reliability of the equipment is improving. However, careful account has to be taken of periods when crowd control measures result in barriers being closed-or left open-in making direct use of UTS data. To date UTS gate information has not been used as a measure of patronage.

Passenger surveys

7. A co-ordinated programme of surveys covering all modes of transport is drawn together by LRT. Its survey strategy was reviewed during 1990 and two main types of survey have been put in place:

(a) on-system surveys, to provide passenger volume and profile data, including attitudes and customer satisfaction; and

(b) wider surveys, based on travel diaries or home interviews.

8. Data collection for these surveys is continuous and is carried out by market research firms. The revised programme of surveys, following a strategy review, was begun in October 1990 and results have yet to emerge. All surveys use samples of the relevant population. Passenger counts and ticket sales data are used to estimate system totals. The strategy appears to be well thought out and offers LUL an acceptable basis for a broad assessment of system use.

System-wide O-D survey

9. In addition to the annual surveys and continuous monitoring described above LUL conducts periodic O-D surveys of its passengers. In broad terms these have been conducted at ten-year intervals. The last survey for which results are available was carried out in 1981. The most recent survey was carried out in 1990 but results are not yet available. Results from the latest available O-D survey are updated annually to provide an estimate of station-to-station demand used in various planning models. A number of adjustments are made to take account of interchange with BR at uncontrolled locations (eg Stratford) but the essential feature is to gross up the O-D matrix to match the entry counts for the current year.

10. LUL plans to have results from the 1990 survey available by the autumn of 1991. At this point it will be possible to match the updated 1981 matrix with the observed 1990 matrix to test the accuracy of the updating process. However, LUL reports that some comparisons have been made. These yielded results within ± 2 per cent in aggregate, but up to ± 20 per cent variations at single locations.

11. Estimates of weekend O-D matrices are derived from applying the results of the occasional week-end entry counts to the weekday O-D matrix. As the distribution of travel and journey lengths is likely to be substantially different on weekends there is likely to be considerable room for error in this process.

Forecasting techniques

12. Travel is a derived demand, consequent upon the level and location of activities in the conurbation. Models which predict transport demands require, as inputs, estimates of a wide range of economic, social and demographic parameters. The validity of the demand forecasts depends upon the accuracy with which these inputs can be estimated, as well as upon the strength of the relationships within the models between travel and the input parameters. Models which are used to predict demand on the Underground can be grouped into two categories, named here short- and long-term. The main characteristics of each group are summarised below.

Short-term models

- ten-year time horizon;
- `marginal models' (predict changes to a known, current pattern of demand);
- single mode (rail only);
- cannot be used to estimate demand for new lines;
- internal to LRT and LUL; and
- relatively simple, microcomputer-based.

Long-term models

- ten years and beyond time horizon;
- `generation models' (produce estimates of demand from basic input variables-knowledge of current demand is still required to calibrate models);
- multi-modal (including private cars);
- used to estimate demand for new facilities;
- external to LRT and LUL;
- weekday, peak period only; and
- complex, mainframe-based. Costly and time-consuming to use.

Short-term models

13. Development of the short-term models within LRT and its predecessor bodies has been going on for many years. Since 1987/88 LUL has developed its own models. Where these can be compared with LRT's models they are largely consistent and produce similar results. There are two sets of models in use: elasticity models and planning models. Each set takes as input an estimate of current demand in the form of a zone-to-zone or station-to-station to matrix.

Elasticity models

14. These apply estimated elasticities to current demand (measured in passenger miles). Separate models exist for peak and off-peak periods and LUL intends to develop its models to allow for further spatial/time-of-day segmentation. The explanatory variables in the model include fares and waiting time (which LUL can influence) and several exogenous variables (such as income, employment and car ownership). The fares and waiting time elasticities in current use are shown in Table 1. Peak demand is inelastic in that a 10 per cent increase in fares will only reduce demand by less than 2 per cent. While off-peak demand is more responsive to price changes, it is still fairly inelastic. A similar picture emerges with respect to waiting times. These models are used to produce annual forecasts of demand and revenues for the business planning round. Because the models are internal to LUL, microcomputer-based and quick and easy to use it is straightforward to apply sensitivity tests in order to explore a wide range of `what if' questions.

TABLE 1 **Fares and waiting time elasticities used by LUL**

	Period of the day						
	am peak	*Between peak*	*pm peak*	*Evening*	*Sat*	*Sun*	*All*
Fares elasticity*	-0.18	-0.29	-0.21	-0.29	-0.31	-0.32	-0.25
Waiting time elasticity	-0.20	-0.56	-0.21	-0.64	-0.71	-0.88	-0.42

Source: LUL.

*Conditional elasticities, ie assuming all public transport fares increase in similar proportions.

15. The models rest on an impressive quantity of research and analysis over the past ten years. The empirical relationships appear to be more soundly-based than in many models of this type. In a situation of a stable network and relatively small change this type of model is an appropriate tool for business planning purposes. However, where a wholly new source of demand and revenue (such as a new line) has to be incorporated into the annual financial planning cycle, external estimates have to be grafted on to the models' output.

Planning models

16. LUL has developed a comprehensive Network Model to predict the way in which travel demands will be manifest on the Underground system. The key input to the model is an estimate of current passenger demand in the form of a station-to-station matrix. This matrix is based on survey data, updated where required (see paragraph 9).

17. Peak-hour demand matrices are then assigned to the rail network by the Network Model. The network includes the entire Underground system, a simplified representation of DLR and the BR network within London and a number of walk links between stations. An `all-or-nothing' procedure is used to assign each station-to-station demand to the network, that is all passengers are assumed to take the minimum generalised time (or cost) route from origin to destination. Development work is in hand to refine the Network Model in order to improve its accuracy.

18. The main outputs of the Network Model are link and line passenger loadings. These give estimates of future demand at individual stations and on specific sections of line. These are used as input to other operational models, for example for station planning and for detailed service planning.

19. In addition to the Network Model LUL has a TSM. This is used to evaluate the effects of service options on a line, or to examine the effects of a change in the provision of infrastructure, such as a signalling scheme. It yields estimates of passenger travel time, average stop-times, regularity and crowding. The model can be used to investigate the effects of changes in:

(a) train features-number of cars, doors, seating, door width, etc;

(b) signalling intervals;

(c) methods of service control-of departures, hindway/headway, station stop-time control;

(d) service frequency;

(e) train performance; and

(f) passenger demand.

Long-term models

20. Forecasting travel demands in the longer term (ten years or more) and for new lines is carried out in the context of London as a whole. The Underground is seen as but one component of a complex transport system and planning studies are joint exercises involving DTp, BR and local authorities, as well as LRT. LUL's input to such studies is relatively modest.

21. Several comprehensive transport studies have been carried out in London since the mid-1960s. The public transport operators and DTp have agreed that, for evaluation of strategic issues, such as the provision of new rail infrastructure, a large, multi-modal model of the conurbation should be used. This model is known as the LTS model and it is in a permanent state of development and improvement, both to reflect new data as they are acquired and new modelling procedures. The CLRS demand forecasts were produced by the LTS model (see paragraph 9.22).

22. The LTS model is generally state-of-the-art, but suffers from a number of disadvantages. Because of the sheer size of the conurbation and the complexity of its transport system the model requires massive computing power and memory to operate. It is thus costly to operate, not only in terms of computing resources, but also in terms of preparing input data. We understand that the main phase of CLRS did not include any sensitivity tests. It was restricted to a `high' and `low' set of input assumptions. It was only in the supplementary work that limited sensitivity tests were carried out.

23. The main argument for using the LTS model is that it attempts to reflect the complex interaction between public and private transport and thus addresses highway congestion issues. Estimates can be made of both user and non-user benefits which could arise from a railway project.

24. Forecasts produced by such models can only be as accurate as the inputs. Such estimates are fraught with uncertainty and history suggests that they are very unreliable. For example, the London Rail Study of 1974 predicted that `morning peak hour traffic on the approaches to Central London would decline by 20 per cent by 1981 and 30 per cent by 1991' (against a 1966 base). The 1981 forecast proved reasonable, but the study assumed that the decline in Central London employment would continue in the 1980s and that the reduction in the radial pattern of commuting would continue. The resurgence of jobs in the central area was not foreseen. The forecast for 1991 was for a decline in demand compared with the actual sharp increase in demand.

25. LRT and LUL recognise a need for a model which can be used much more quickly and easily than the LTS model to facilitate sensitivity tests. LRT is in the process of developing such a model (known as RAILPLAN) which will be compatible with the LTS model. This will allow LUL to evaluate a wider range of variants to the main CLRS alternatives as traffic patterns develop in the 1990s.

Market research

26. Paragraphs 1 to 11 described a range of passenger surveys carried out by LRT and LUL. These surveys not only quantify demands for travel on the Underground but also give information about customer profiles, market penetration of different types of ticket and the extent of travel by other means. The empirical work underlying the elasticities used in the short-term demand models offers a sound basis for estimating how the Underground travel market will change in response to changes in price and levels of service.

27. In addition to this system-wide research LUL carries out market research into specific topics or proposed system improvements as needs dictate. Often these studies are conducted by specialist consultants on LUL's behalf. Recently, stated preference techniques have been used in an attempt to establish customers' willingness to pay for improvements. Significant revenue benefits were estimated from potential improvements, especially off-peak.

Relationship between quality of service and demand

28. LUL recognises that demand is influenced by the quantity and quality of service on offer. Congestion will have the effect of depressing demand, whereas a more frequent, uncongested service has the potential to attract more traffic. These effects are taken into account in LUL's demand modelling procedures.

29. Most transport models, including those used by LRT and LUL, incorporate mode and route choice procedures based on the conventional economic theory. In making a travel choice a prospective passenger is assumed to choose that option which minimises his disutility arising from the journey. The disutility of a journey is described in terms of generalised cost.

APPENDIX 11.1
(referred to in paragraph 11.31)

Project appraisal

1. This appendix describes the appraisal criteria agreed between LRT and DTp for the evaluation of projects in the UIP.

2. DTp's guidance says that:

> The appraisal should provide a general discussion of the genesis of the project and how the options examined were identified. A range of options must be considered, the exact number being dependent on the case at issue. All appraisals must develop a suitable base case, eg no investment, minimum investment, modern equivalent asset or transfer to the private sector as appropriate. Modern equivalent asset is the minimum full life cost replacement of existing levels of capacity. If anything other than no investment is selected as the base case, it should be explained why the investment cannot be avoided. The preferred option should include where appropriate:
>
> *(a)* separate identification of independent elements of the project;
>
> *(b)* considerations of possible variations in scale;
>
> *(c)* considerations of possible variations in timing;
>
> *(d)* the interaction with any other projects approved or planned.
>
> For large projects it may be appropriate to address these points for all the options examined.

Financial effects

3. The first part of the appraisal involves an assessment of the financial effects of the project, on an incremental basis where appropriate, based on existing fares assumptions. These would normally include:

(a) capital costs, including building, equipment and land (both acquisition and preparation);

(b) implementation costs;

(c) running costs over the life of the project, including allowances for renewals;

(d) revenue receipts;

(e) capital contributions from all sources, excluding Government grants;

(f) costs of severance; and

(g) residual values of assets remaining at the end of the project's life.

For evaluations within LUL the revenue receipts exclude any revenue gained from passengers transferring from bus to Underground less any consequential cost savings that can be made by LRT through a reduction or change in its bus services.

4. Appraisal is undertaken incrementally, where appropriate, to ensure that each part of a project is justified. So, for example, when purchasing new rolling stock the benefits of CCTV in the cab would be evaluated separately. In carrying out evaluations incrementally it is important to avoid double counting of

the benefits. It is also important to identify where benefits arise because of synergies between different elements of the project.

5. An improvement in services resulting from a project is likely to increase patronage and, hence, revenue. LUL assesses the effect on revenue receipts of the passenger benefits of a project by assuming that the passenger benefits represent, in money terms, an equivalent reduction in fares. The fares elasticity is then used to derive the additional demand that will be generated by the project. And from this the additional receipts are derived.

6. Costs and revenues are expressed in constant prices and are discounted at 8 per cent to give a net present value of each option. Account is taken of costs which may increase at above or below the general rate of inflation. Assets are valued at their opportunity cost; that is their full value in the use to which they would otherwise be put, or their residual value if there is no alternative use.

7. If a project shows a positive net present value at this stage it is justified on financial grounds under the DTp guidelines. But LUL told us that its appraisals also consider the passenger effects of projects which affect the level or quality of service.

Passenger benefits

8. Passenger benefits are based on an assessment of what passengers would be willing to pay for the improvement in the service. The DTp guidelines say that a passenger's willingness to pay should be demonstrated preferably by revealed preference methods or, if that is not possible, by stated preference techniques.

9. For the purposes of the appraisal DTp has advised LRT to assume that fares are increased up to the full value passengers attach to the improvements. The project is then approved if the net present value of the additional revenue generated from this increase in fares, after taking account of its effect on demand, exceeds the net present financial cost of the project.

10. This method of allowing for passenger benefits is different from that used in previous LUL appraisals. In the past LUL has assumed that fares remain unchanged. Instead LUL compared the net present value of the passenger benefits with the net financial costs and as a minimum set a pass mark of £1.3 passenger benefits to £1 financial cost. LUL considers that the effect of this is equivalent to assuming prices are increased to the full value that passengers attach to the improvements.

External benefits

11. Where projects are not justified on their financial effects or passenger benefits they may be justified if account is also taken of their external benefits, such as the relief of road congestion. In this case the same criterion is applied: the net present value of benefits must exceed the net present value of costs.

Sensitivity

12. The DTp advice on sensitivity tests is that these:

> must be presented showing the effects on the NPVs for the preferred option of changes in the main underlying assumptions. The variations explored should be based on realistic variations in single factors and combinations of factors, especially where factors are likely to vary together, rather than a standard +/-X per cent approach. Where possible some estimate of the probability of such variations should be provided.

Measurement of passenger benefits

13. The measurement of passenger benefits has to be agreed with DTp. The use of willingness-to-pay as the criteria for assessing passenger benefits is a recent development and has yet to be fully taken account of in the LUL appraisals. At present LUL values passenger benefits in two ways. Time savings to passengers are valued at the resource values of time. Non-working time is based on the DTp Standard National Value of £2.075 each hour at 1988 prices (see DTp Highway Economics Note 2, May 1989) and is the same for all passengers and modes of travel. The value of working time for Underground passengers is £9.046 each hour (see the DTp note referred to above). The value of time is based on a weighted average of non-work and work time.

14. In calculating the time savings to passengers LUL adjusts the times saved to reflect the unpleasantness of such factors as walking, waiting and congestion. These adjustments are outlined in Appendix 9.1, paragraph 30. In essence the time is increased where waiting and walking are involved, particularly where there is congestion. So, for example, one minute saved on a congested journey is worth more than one minute saved on an uncongested journey. All the adjustments used are derived empirically from observing Underground journeys where trade-offs are being made between, for example, two routes between the same two stations, one involving a longer journey but no interchange and the other a shorter journey but with an interchange.

15. Non-time benefits are appraised on the basis of passengers' willingness-to-pay derived using stated preference techniques. Stated preference techniques can give implausible high values and LUL appears to have taken care in their use. For example, in the case of the Northern Line renewal the benefits were assessed with and without passenger benefits such as comfort, cleanliness and noise. LUL commissioned consultants to look at the non-time benefits for the Northern Line Project. The consultants reported in September 1990 and on the basis of their findings the original estimate of the non-time benefits in the project was reduced by two-thirds.

APPENDIX 13.1
(referred to in paragraphs 13.2 and 13.34)

Schedule of income and expenditure for property, advertising and ancillary services, 1987/88 to 1994/95

Constant (1990/91) prices, £ million

	1987/88 actual	*1988/89 actual*	*1989/90 actual*	*1990/91 budget*	*1991/92 plan*	*1992/93 plan*	*1993/94 plan*	*1994/95 plan*
Income								
Rental income								
Rents (other)		12.27	11.22	9.80	10.40	11.30	12.00	14.30
Retail (rents)		9.91	10.12	10.50	11.20	13.00	14.00	15.00
Vending		-	(0.11)	0.40	1.00	1.00	1.00	1.00
Photo-Me	20.92	-	0.33	0.30	0.30	0.30	0.30	0.30
Telephones		0.59	0.55	1.70	1.70	1.70	1.70	1.70
Telepoints		-	-	0.10	0.20	0.20	0.20	0.20
New rent (other)		-	-	-	0.30	0.10	1.00	0.60
New rent (retail)		-	-	-	1.00	0.30	0.20	-
Rents receivable	20.92	22.77	22.11	22.80	26.10	27.90	30.40	33.10
Commercial advertising	16.76	17.70	18.48	19.30	20.00	21.00	24.40	25.00
Televenture	0.38	0.59	0.55	0.51	0.55	0.55	0.55	0.55
External/other	0.38	1.30	4.73	4.50	3.60	3.60	3.60	3.60
Total income	38.44	42.36	45.87	47.11	50.25	53.05	58.95	62.25
Expenditure								
Retail (rents)	3.28	0.94	0.55	0.80	0.90	0.90	1.00	1.00
Other (rents)		1.30	1.65	1.30	1.35	1.50	1.55	1.70
Commercial advertising	5.17	5.19	5.50	6.50	7.10	7.60	10.10	9.80
External/other	0.38	1.42	4.73	4.50	3.60	3.60	3.60	3.60
Total expenditure	8.83	8.85	12.43	13.1	13.0	13.6	16.3	16.1
Net profit (LUL)	29.61	33.51	33.44	34.01	37.30	39.45	42.70	46.15
Development (LUL)								
Disposals/proceeds (cash)	N/A	14.16	16.50	47.00	11.00	28.00	35.00	55.00
Expenditure (net)	N/A	(5.90)	(6.05)	(7.00)	(3.00)	(2.00)	(6.00)	(6.00)
NET	N/A	8.26	10.45	40.00	8.00	26.00	29.00	49.00
Per statutory LRT accounts (all companies)	89.46	90.86	41.80	42.80	18.50	39.50	51.30	51.90

Source: LUL.

Notes:

1. In uplifting the figures for 1987/88 to 1989/90 to 1990/91 figures, the following indices have been used, based on a standard annual calculation of RPI:

1987/88	126
1988/89	118
1989/90	110
1990/91	100

2. *Rents receivable*
The figures reflected in the schedule for 1990/91 and onwards are those budgeted/planned but are being constantly updated in the light of changing market circumstances, and of the funding problems of LUL. Specifically, it has not been possible to proceed with all the planned investment in retail and vending programmes, and this will have an adverse effect on future income streams.

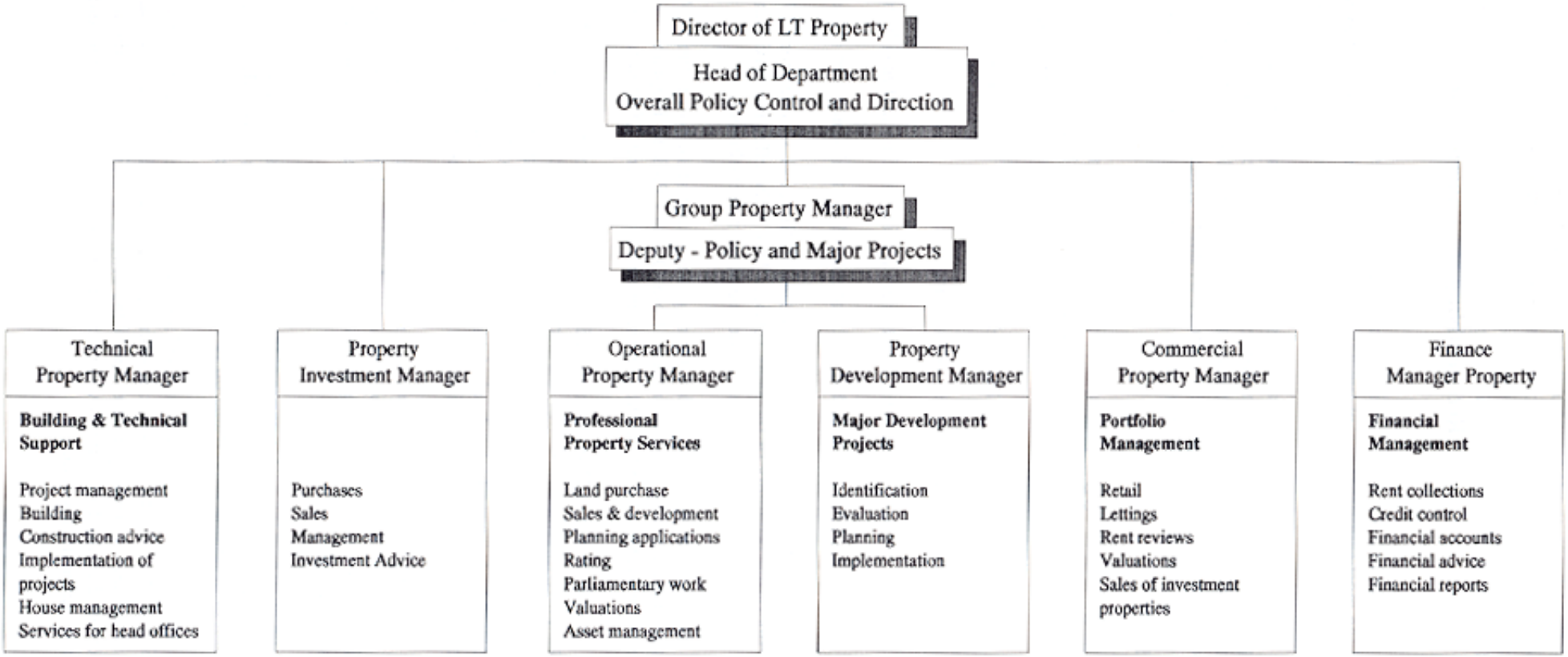
3. *Commercial advertising*
This figure covers the gross income from LTA's exploitation of all LUL sites both directly and through third party associations.

4. *External/other*
Care must be taken in comparing actual figures for years up to 1989/90 with budgeted figures for 1990/91 onwards. This is because of the different treatment of external/other income in statutory and management accounts. The statutory accounts include, under external/other income, inter-company sales by LUL internal contracting units to other LRT subsidiary companies, but these are not included under this heading in the management accounts. The amount involved is £3.3 million per annum from 1990/91 onwards.

5. *Development*
All the figures quoted which make up net profit are calculated on an accruals basis for use within the profit and loss account. In addition to income from rents etc, capital receipts are received from the sale and development of property assets. These receipts form part of LRT's income for IFR purposes and are shown here as cash figures.

APPENDIX 13.2
(referred to in paragraph 13.8)

LT Property: divisional structure



Source: LUL.

APPENDIX 14.1
(referred to in paragraph 14.61)

Retimetabling the Bakerloo Line

1. To illustrate the type of decision-making involved in revising timetables, this appendix examines one of the most significant recent timetable changes: that concerning the Bakerloo Line in May 1990. Timetabling issues are also discussed in the Metropolitan Line case study (see Appendix 2.1).

2. The Bakerloo Line management used a `clean sheet' approach. They knew that their problems were punctuality and recovery from disruptions, and suspected that some of the running times needed adjustment. Experience, and examination of failure and delay statistics, had shown that the service suffered from fundamental problems caused by interworking with the BR service north of Queen's Park. It was, therefore, decided to make the dovetailing of the BR and Bakerloo Line services the main priority.

3. A joint working group composed of Bakerloo Line management, the timetable compiler, the Line Controller, Train Service Development and BR Area Management staff developed a strategy. At the same time they reviewed the level of service provided. They decided to:

(a) maintain the existing peak hour scheduled frequency of 22 TPH;

(b) develop more soundly based running times;

(c) examine the arrival pattern of customers joining the line and match the service to it;

(d) adjust the interworking of BR and Bakerloo Line trains north of Queen's Park; and

(e) increase the number of trains operating in the peak service from 27 to 28 to improve the operating reliability of the peak service. This is the effective maximum that can be provided from the rolling stock resources during stock refurbishment.

4. Train checking staff sampled running times and station-stop times. As a result the overall scheduled running time for a round trip from Queen's Park to Elephant and Castle and back was increased on average by 3.5 minutes in the morning peak and 1.5 minutes in the evening peak.

5. Data from the O-D survey updated by station entry counts were used to determine the service demand patterns. The TSM was used to analyse the effects on passenger journey times and on crowding of a range of types of service. The marginal revenue benefit was calculated and compared with marginal cost for 30-minute periods throughout the day. As traffic levels at the shoulders of the peak period had risen, a higher level of service then could be justified. Also a dip in demand occurred between 10 am and 12 noon enabling the service to be reduced slightly to match.

6. `Stepping back' of train crews was introduced at Elephant and Castle to allow the shorter turnround time needed to increase the frequency during peak periods. `Stepping back' is a method of reversing trains quickly by changing train operators at a terminal. This was achieved with the existing level of train staff.

7. Feedback on the performance of the new timetable was encouraging. With additional scheduled running time, trains arrive consistently on time at Queen's Park. BR signalmen experience fewer problems in accepting LUL trains on to their system as a result.

8. Recovery rates have improved and a right time service is regularly achieved by 10 am each day following the Monday to Friday peak. Although the increased running times and the reduction of two trains in the late morning period reduced the scheduled train mileage, the actual mileage operated has increased owing to the improved reliability. Both excess waiting time and customer complaints have been dramatically reduced.